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for the
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IN THE

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

No. 13,624

GREAT LAKES CARBON CORPORATION, *Appellant*,

v.

ROBERT C. WATSON, Commissioner of Patents, *Appellee*.

Appeal From the United States District Court for the District of Columbia

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JOINT APPENDIX

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74 Filed May 25, 1954

IN THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

Civil Action No. 2231-'54

Great Lakes Carbon Corporation, 18 East 48th Street, New York, N. Y., *Plaintiff*

v.

Robert C. Watson, Commissioner of Patents and/or his successors in office, United States Patent Office, Washington 25, D. C., *Defendant*

Complaint Under Title 35, U.S.C. Section 145 Seeking Issuance of Letters Patent

The plaintiff states as follows:

1. That plaintiff, Great Lakes Carbon Corporation, a corporation of Delaware, with principal offices at 18 East 48th Street, New York, N. Y., brings this suit in its own right;

2. That defendant, Robert C. Watson, Commissioner of Patents, and/or his successors in office, is a citizen of the United States and, in his official capacity, is a resident of the District of Columbia;

3. That this Court has jurisdiction of this cause of action because of the residence of the defendant in the District of Columbia and because this case arises under the patent laws of the United States and, more specifically, under 35 U.S.C. 145, effective January 1, 1953;

75 4. That on August 11, 1951, John W. Kenney, Jr. and Armand R. Bollaert duly filed in the United States Patent Office Application Serial No. 241,398 for "Perlitic Mineral Filteraids" and that the plaintiff is the owner of the entire right, title and interest in and to said patent application by assignment;

5. That the said patent application is directed to an invention which is cognizable in law and in equity as patentable under the laws of the United States and rules of the United States Patent Office;

6. That on August 22, 1952, the said patent application was erroneously rejected by the primary examiner on the second action;

7. That on January 14, 1953 the applicants appealed to the Board of Appeals;

8. That the claims rejected by the examiner are as follows:

1. A filter aid consisting essentially of the comminution product of an artificially expanded, multi-cellular perlitic mineral, said product containing not more than 40% by weight of particles smaller than 3 microns and not more than 20% by weight of particles larger than 40 microns, said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

2. A filter aid consisting essentially of the comminution product of an artificially expanded perlitic, multi-cellular mineral, said product containing not more than 8% by weight of particles smaller than 3 microns, not less than 50% by weight of particles larger than 10 microns, and not more than 20% by weight of particles larger than 40 microns, said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

76 3. A filter aid consisting essentially of the comminution product of an artificially expanded perlitic, multi-cellular mineral, said product having the following range of particle size:

Smaller than 3 microns .... 0% to 8%
“ “ 6 “ .... 0% to 20%
“ “ 10 “ .... 12% to 50%
“ “ 20 “ .... 60% to 90%
“ “ 40 “ .... 80% to 100%

said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

4. A filter aid according to Claim 3 having a cake density of between about 10 and about 20 lbs. per cu. ft.

5. A filter aid consisting essentially of the comminution product of an artificially expanded, multi-cellular perlitic mineral, said product containing not more than 15% by weight of particles smaller than 3 microns, not more than 45% by weight of particles larger than 10 microns, and not more than 5% by weight of particles larger than 40 microns, said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

6. A filter aid consisting essentially of the comminution product of an artificially expanded, multi-cellular perlitic mineral, said product having the following range of particle size:

Smaller than 3 microns .... 5% to 15%
“ “ 6 “ .... 15% to 50%
“ “ 10 “ .... 55% to 85%
“ “ 20 “ .... 85% to 100%
“ “ 40 “ .... 95% to 100%

said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

7. A filter aid according to Claim 6 having a cake density of between about 10 and about 20 lbs. per cu. ft.

8. A filter aid consisting essentially of the comminution product of an artificially expanded, multi-cellular perlitic mineral, said product containing not more than 40% by weight of particles smaller than 3 microns, and not more than 25% by weight of particles larger than 10 microns, said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

77 9. A filter aid consisting essentially of the comminution product of an artificially expanded, multicellular perlitic mineral, said product having the following range of particle size:

Smaller	than	3	microns	15% to 40%
“	“	6	“	50% to 90%
“	“	10	“	75% to 100%
“	“	20	“	90% to 100%

said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

10. A filter aid according to Claim 9 having a cake density of between about 10 and 20 lbs. per cu. ft.

12. A process according to claim 20 wherein the particle size distribution of the resulting filter aid product is as follows:

Smaller	than	3	microns	0% to 8%
“	“	6	“	0% to 20%
“	“	10	“	12% to 50%
“	“	20	“	60% to 90%
“	“	40	“	80% to 100%

13. A process according to Claim 20 wherein the particle size distribution of the resulting filter aid product is as follows:

Smaller than 3 microns	5% to 15%
" " 6 "	15% to 50%
" " 10 "	55% to 85%
" " 20 "	85% to 100%
" " 40 "	95% to 100%

14. A process according to Claim 20 wherein the particle size distribution of the resulting filter aid product is as follows:

Smaller than 3 microns	15% to 40%
" " 6 "	50% to 90%
" " 10 "	75% to 100%
" " 20 "	90% to 100%

16. A process according to Claim 21 wherein the filter aid is recovered by selective flotation and wherein the filter aid product contains not more than 40% by weight of particles smaller than 3 microns and not more than 20% by weight of particles larger than 40 microns.

78 17. A process according to Claim 21 wherein the bulk density of the expanded, cellular perlite is between about one and about six lbs. per cu. ft. and wherein the filter aid product contains not more than 40% by weight of particles smaller than 3 microns and not more than 20% by weight of particles larger than 40 microns.

18. A filter aid according to Claim 6 having a cake density of less than 22 lbs. per cu. ft.

19. A filter aid according to Claim 9 having a cake density of less than 22 lbs. per cu. ft.

20. (Rewritten Claim 11) A process for producing a filteraid which comprises expanding a perlitic mineral to form a low bulk density, multi-cellular aggregate, comminuting said aggregate to produce a fragmental product whose particles are substantially less than 149 microns in size and which contains not more than about 40% by weight of particles smaller than three microns in size, the

milled product further having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

21. (Rewritten Claim 15) A process for producing a filteraid from artificially expanded, low bulk density, multicellular perlite aggregate which comprises comminuting said agggregate to produce a fragmental product whose particles are substantially less than 149 microns in size and which contains not more than about 40% by weight of particles smaller than three microns in size, the milled product further having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

9. That the following art was relied upon by the primary examiner as a basis for the erroneous rejection:

Published article entitled, "New Insulating Material", appearing in Compressed Air Magazine, Vol. 47, page 6694 of 1942 and the article entitled, "Thermal Insulation from Perlite Rock" appearing in Chemical and Metallurgical Engineering, Vol. 52, pages 140 and 142 of July 1945 and upon Thatcher, United States Reissue Patent 19,166, dated May 15, 1934.

79 10. That the examiner erroneously rejected the application on the ground of *res adjudicata* based upon the Decision of May 14, 1952 by the Patent Office Board of Appeals affirming the final rejection of claims 18 to 25, inclusive, of applicants' parent application Serial No. 688,430.

11. That on March 31, 1954 the Patent Office Board of Appeals erroneously affirmed the rejection of claims 1 through 10, 12, 13, 14 and 16 through 21 of Serial No. 241,398.

12. That no appeal from the Decision of the Patent Office Board of Appeals dated March 31, 1954 has been taken to the Court of Customs and Patent Appeals.

13. That on information and belief, the Commissioner of Patents has refused and still refuses to grant Letters Patent on the invention embraced by claims 1 through 10, 12, 13, 14 and 16 through 21, of Serial No. 241,398, although the plaintiff is lawfully entitled thereto;

Wherefore, plaintiff prays that this Honorable Court shall judge that the plaintiff is entitled to have claims 1 through 10, 12, 13, 14 and 16 through 21 allowed in said application Serial No. 241,398 and shall authorize the said defendant, the Commissioner of Patents, to issue to the plaintiff a patent on said application containing
80 said claims on the filing in the Patent Office of a copy of this Court's adjudication and otherwise complying with the requirements of law, and for such other and further relief as the nature of the case may require and which to this Honorable Court shall appear proper.

Great Lakes Carbon Corporation
By Richard McAvoy
Richard McAvoy,
Vice President

Burns, Doane, Benedict & Irons
W. L. Benedict
James P. Burns
Wayne L. Benedict
Of Counsel

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81 Filed June 17, 1954

Answer to the Complaint

To the Honorable the Judges of the United States District Court for the District of Columbia

1. The defendant is not informed as to the allegation of paragraph 1 of the complaint.

2, 3. He admits the allegations of paragraphs 2 and 3.

4. He is not informed as to the allegations of paragraph 4.

5. He denies the allegation of paragraph 5.

6. He admits that the application here involved was rejected as alleged in paragraph 6. He denies that
82 that rejection was erroneous.

7, 8. He admits the allegations of paragraphs 7 and 8.

9, 10, 11. He denies that any of the actions referred to in paragraphs 9, 10, and 11 were erroneous. He admits the remaining allegations of those paragraphs.

12. He admits the allegations of paragraph 12.

13. He admits that he has refused and still refuses to grant Letters Patent as alleged in paragraph 13. He denies that the plaintiff is lawfully entitled thereto.

Further Answering, the defendant states that the plaintiff is not entitled to a patent containing any of the claims set forth in the complaint for the reason that plaintiff has not established title to the application here involved and for the further reasons set forth and the references cited in the Examiner's answer and the decision of the Board of Appeals in the application here-involved. Profert of copies of the said answer, decision, and references is hereby made.

E. L. Reynolds
Solicitor, U. S. Patent Office,
Attorney for Defendant.

June 16, 1954

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83 Filed March 23, 1956

Amendment of Plaintiff's Complaint

The Plaintiff, with the consent of the Defendant, hereby moves to amend its complaint as follows:

Strike Section 8 of the original complaint and substitute the following:

8. That the claim rejected by the examiner is as follows:

17. A process for producing a filteraid from artificially expanded, low bulk density, multi-cellular perlite aggregate which comprises comminuting perlite aggregate having a bulk density between about one and about six pounds per cubic foot to produce a fragmental product whose particles are substantially less than 149 microns in size and which contains not more than about 40% by weight of particles smaller than three microns and not more than 20% by weight of particles larger than forty microns in size, the milled product further having the property
84 of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

W. L. Benedict
Counsel for Plaintiff

Mar. 23, 1955
Consented to
C. W. Moore
Solicitor, United States
Patent Office for Defendant

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85 Filed March 23, 1956

Memorandum Accompanying Plaintiff's Amendment to the Complaint

Attached hereto is an amendment of plaintiff's complaint which has been consented to by the Solicitor of the United States Patent Office, and also a stipulation with respect to dismissal of the complaint as to the other claims, this to be with prejudice but without judgment on the merits. The amended complaint merely combines the subject matter of claim 17 and claim 21 so that claim 17 will appear in the usual independent form. It in no way alters the issues with respect to this claim nor does it in any way change the scope thereof. It is respectfully requested that the honorable court grant the plaintiff's motion.

W. L. BENEDICT
Attorneys for Plaintiff

86 Filed March 23, 1956

Stipulation

It is hereby stipulated by and between the parties that the complaint be dismissed with prejudice but without judgment on the merits, with respect to claims 1-10, 12-14, 16 and 18-21.

That the subject matter of claim 17, which presently is dependent upon claim 21, shall be rewritten in independent form in accordance with the claim presented in Plaintiff's Motion to Amend its Complaint, filed concurrently herewith.

3/23/56 W. L. BENEDICT
Attorneys for Plaintiff

C. W. MOORE
Attorneys for Defendant

87 Filed June 20, 1956

Memorandum

The Court is unable to find in this claim any advance over the prior art that rises to the dignity of invention. Accordingly, the complaint is dismissed. Order accordingly. Counsel will prepare tentative findings of fact and conclusions of law.

MATTHEW F. MCGUIRE
Matthew F. McGuire
United States District Judge

June 20, 1956

87A Filed August 23, 1956

Findings of Fact

1. This is an action under 35 U.S.C. 145 in which the plaintiff, owner by assignment of the application for patent of John W. Kenny, Jr., et al., Serial No. 241,398, seeks by the amended complaint, a decree, of this Court authorizing the issuance of a patent upon claim 17 of the said application, which claim was refused by the Board of Appeals, and which claim reads as follows:

17. A process for producing a filter aid from artificially expanded, low bulk density, multi-cellular perlite aggregate which comprises comminuting perlite aggregate having a bulk density between about one and about six pounds per cubic foot to produce a fragmental product whose particles are substantially less than 149 microns in size and which contains not more than about 40% by weight of particles smaller than three microns and not more than 20% by weight of particles larger than forty microns in size, the milled product further having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

2. The application in suit relates to perlitic mineral filteraids and discloses a process or method for producing such filter aid from an artificially expanded perlite 87B aggregate. Perlite aggregate is selected having a bulk density between about one and six pounds per cubic foot. This aggregate is comminuted or ground into a fragmental product. The sizes of the particles in the ground product are graded in size as stated in claim 17.

3. The patent to Thatcher, Reissue No. 19,166, relates to a filter aid in which it is taught to use ground diatomaceous earth filter particles which are graded in size substantially as stated in claim 17.

4. The Compressed Air Magazine, Vol. 47, page 6694, discloses that perlite, expanded by heat, when ground to a 40-80 mesh is suitable for filtering water.

5. The publication Chemical and Metallurgical Engineering, Vol. 52 at pages 140 and 142, teaches that perlite can be expanded by heating to produce a light material, and that the result of this "explosion" is that the siliceous material almost instantly solidifies around minute air and moisture bubbles, thus sealing them to give a light material having 6-10 times the volume of the original rock and weighing anywhere from just a few pounds up to 10 lb. per cu. ft., depending upon the the method and temperature of explosion. At page 142, among the suggested uses of exploded perlite so produced is "filter aid."

6. It was not a matter of invention, in view of the prior art, to make filter aid from expanded perlite by grinding or comminuting starting material having a density of from one to six pounds per cubic foot.

7. It was not a matter of invention to grade the particle sizes to the values specified in claim 17 in suit, in view of the teaching of substantially similar values 87C of particle sizes in the prior art patent to Thatcher for use in a filter aid made from diatomaceous earth particles.

8. Claim 17 in suit defines no invention over the prior art.

9. There is not in claim 17 anything that defines any advance over the prior art that rises to the dignity of invention.

10. Claim 17 in suit is not patentable over the prior art.

Conclusions of Law

1. Plaintiff is not entitled to a patent containing claim 17 in suit.

2. The complaint should be dismissed.

Matthew F. McGuire
Judge

8/23/56

87D Filed August 23, 1956

Judgment

This action came on to be heard at this term, and thereupon upon consideration thereof, it is this 23rd day of August, 1956,

ADJUDGED that the complaint be and it is hereby dismissed with costs against the plaintiff.

MATTHEW F. MCGUIRE
Judge

Approved as to Form:

W. L. BENEDICT
Attorney for Plaintiff

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88 Filed October 22, 1956

Notice of Appeal

Great Lakes Carbon Corporation, Plaintiff above named, hereby appeals to the United States Court of Appeals for the District of Columbia from the order of the Judge in the United States District Court for the District of Columbia dismissing the above entitled action with costs, entered in this action on August 23, 1956.

BURNS, DOANE, BENEDICT & IRONS
By W. L. BENEDICT
Wayne L. Benedict
c/o Burns, Doans, Benedict & Irons
850 Munsey Building
Washington 4. D. C.

1 Filed November 29, 1956

EXCERPTS FROM TRANSCRIPT OF TESTIMONY

Washington, D. C.
Tuesday, May 1, 1956.

The above-entitled action came on for trial at 10:00 o'clock a.m., Tuesday, May 1, 1956, in the United States District Court for the District of Columbia.

* * * * * * * * * *

2

Exhibits

Plaintiff's

1—Assignment of Application
2—History of Application. Serial No. 241,398
3-A through 3-F—Photographs
4—Compressed Air Magazine, March 1942
5—Chemical and Metallurgical Magazine, July, 1945
6—Thatcher Reissue Patent No. 19,166
7—Photograph of diatomaceous earth
8—Table of Bulk and Cake Densities of Aggregates
9—Chart, Properties of Filter Aids used in Charts A and B
10—Chart, Comparison of Product of Invention
11—Chart, Effect of Aggregate Density on Flow Rate of Perlite Filter Aids

* * * * * * * * * *

25 Mr. Benedict: Your Honor, I should like to present Plaintiff's Exhibit No. 1, the assignment of the application in suit. Is that satisfactory to you to put in a photostatic copy?

Mr. Miller: No objection.

Mr. Benedict: By agreement with the Solicitor prior to trial it was agreed that we could introduce a typed copy of the application in suit, and this is a typed copy of the file of that case, with the exception that the photographs which form a part of the original case are not here. I will mark that the second exhibit and this is, of course, with the stipulation that if there are any inaccuracies or any corrections to be made in this typed copy that they can be made.

26 Mr. Miller: No objection.

Mr. Benedict: I offer this as Plaintiff's Exhibit—I offer the history of Application Serial No. 241,398, Kenney, et al., as Plaintiff's Exhibit No. 2.

Mr. Miller: No objection.

Mr. Benedict: I believe you have copies of all of these.

(Assignment of application in suit was by the Court received in evidence as Plaintiff's Exhibit No. 1.)

(History of application Serial No. 241,398 was by the Court received in evidence as Plaintiff's Exhibit No. 2.)

Mr. Benedict: I should like to offer these as Plaintiff's Exhibit 3-A, 3-B, 3-C, 3-D, 3-E, and 3-F.

Mr. Miller: No objection to any of those.

(Thereupon photographs marked Plaintiff's Exhibit 3-A through 3-F were by the Court received in evidence.)

Mr. Benedict: I will call as my first witness Dr. Paul W. Leppla.

Thereupon,

Dr. Paul W. Leppla

was called as a witness on behalf of the plaintiff and, being first duly sworn, was examined and testified as follows:

Direct Examination

By Mr. Benedict:

27 Q. Will you please state your name, age, residence, and occupation? A. Paul W. Leppla.

Q. Spell it, please. A. L-e-p-p-l-a, age 45, residing in Palos Verdes, P-a-l-o-s V-e-r-d-e-s, Estates California. I am a chemist.

Q. For whom do you work? A. I work for the Great Lakes Carbon Corporation.

Q. What is your present position? A. I am technical director of the Dicalite and perlite division.

Q. How long have you been employed by the Great Lakes Carbon Corporation? A. Nine years.

Q. I hand you—I think possibly I had better introduce the other copy in evidence of those three references.

The Court: All right. Well, he may want those.

Mr. Benedict: I have forgotten how you designated those, Mr. Miller.

Mr. Miller: Well, the names are on the front of my folder.

Mr. Benedict: I will introduce these, to save time, as Plaintiff's—the article appearing in Compressed Air Magazine, page 6694 as Plaintiff's Exhibit—

The Court: That is 1942 volume?

28 Mr. Benedict: That is 1942, yes, as Plaintiff's Exhibit 4.

Mr. Miller: No objection.

(Thereupon Volume of Compressed Air Magazine, March, 1942, was by the Court received in evidence as Plaintiff's Exhibit No. 4.)

Mr. Benedict: Your Honor, I should like to introduce in place of that exhibit, I should like to introduce the entire Compressed Air Magazine of March, 1942, pertaining to this.

Mr. Miller: No objection to that, either.

Mr. Benedict: I should like to introduce July, 1945 Chemical and Metallurgical Engineering article, page 140 and 142 as Plaintiff's Exhibit 5.

Mr. Miller: No objection.

(Thereupon pages 140 and 142 of article July, 1945, Chemical and Metallurgical Engineering was by the Court received in evidence as Plaintiff's Exhibit No. 5.)

The Court: So these exhibits will be in harmony one with the other this is Volume 52.

Mr. Benedict: And the Thatcher Reissue Patent No. 19,166, May 15, 1934, to be introduced as Exhibit 6.

Mr. Miller: No objection.

29 (Thereupon Thatcher Reissue Patent No. 19,166, reissue May 15, 1934 was by the Court received in evidence as Plaintiff's Exhibit No. 6.)

By Mr. Benedict:

Q. Dr. Leppla, I hand you a copy of the Compressed Air Magazine article, Plaintiff's Exhibit No. 4, and I read you as follows:

"Upon examination under a microscope it was found—"

The Court: Now, will you excuse me, please? Where are you reading from now?

Mr. Benedict: I am reading from—

The Court: Under what subheading, under "New Insulating Material"?

Mr. Benedict: New Insulating Material, yes, sir.

The Court: I see. The last sentence, the second last sentence, "Upon examination under a microscope it was found that the product had a porous structure—"

By Mr. Benedict:

Q. —"and that the pores were well sealed."

Does this agree with your definition of expanded perlite, as you understand that term? A. Yes, sir.

Q. You are familiar with the expansion of perlite?

30 A. Yes, sir.

Q. You have worked in this field during your employment with the Great Lakes Carbon Corporation? A. Yes, sir.

Q. Over what period of time? A. With perlite for about seven years.

Q. I hand you a copy of the Chemical and Metallurgical Engineering article and read you the following:

"The result of this 'explosion' is that the siliceous material almost instantly solidifies around minute air and moisture bubbles, thus sealing them to give a light material having 6-10 times the volume of the original rock and weighing anywhere from just a few pounds up to 10 pounds per cubic foot, depending upon the method and temperature of explosion."

Does the first portion of that with respect to the sealed cells agree with your definition of expanded perlite, Dr. Leppla? A. Yes, sir.

Q. I refer you to the second page of the Chemical and Metallurgical Engineering article and read the statement:

> "As a result of experiments since that time, suggested uses of exploded perlite include"—inter alia —"a filter aid."

31

What do you understand that to mean, what type of perlite is he referring to? A. He says, "exploded perlite."

Q. And you have defined that as meaning a vesicular material? A. Yes, sir.

Q. Is an exploded or expanded perlite, being vesicular, a filter aid? A. It is not.

Q. I note also that reference is made to expansion or explosion from 6 to 10 times the volume of the original ore.

The Court: Dr. Leppla, it says in this article to which counsel has called your attention, "As a result of experimentation since that time, suggested uses of exploded perlite include," among other uses "filter aids."

Your answer to that is that exploded perlite could not be a filter aid?

The Witness: That is right.

The Court: I am assuming you have made experimentations, have you?

The Witness: Yes, sir.

The Court: Then how do you account for the claim, unequivocal difference of opinion, between what is stated in the article, and what you stated? The article states

32 as a result of experimentation it is found to be a filter aid, and you say categorically it is not.

The Witness: The technique of filter aids is very special. There are relatively few people who are familiar with the requirements to make a filter aid. It seems to me clear from examining the language of this article, that the gentleman who prepared it, who is anonymous in this reference, was not at all familiar with filter aids. I believe that he was misled into making this suggestion by the fact that exploded perlite is a light weight material, but filter aids are also a light weight material, but their characteristics are entirely different in that filter aids are light weight because of the large space occurring between the particles whereas the exploded perlite, as he explains, with sealed voids contains the void volume within the particle, and is sealed off from any useful purpose as a filter aid.

The Court: Well, it comes down to this, that you as a chemist do not go along with that statement?

The Witness: No, I think he made that suggestion through his misunderstanding of filter aids.

The Court: Well, he says, "As a result of experimentation," he says it is suggested, "As a result of experimentation since that time, suggested uses of exploded perlite include," and my point is that if the article purports to be one written by a chemist, he has indicated that
33 there has been some experimentation looking to the results mentioned here.

Mr. Benedict: Your Honor, perhaps I can be of some help to you by referring Dr. Leppla to the original magazine in which that article appeared, and ask him if this—what is the nature of the magazine?

The Court: That may help.

The Witness: This magazine is a periodical devoted to encouraging the use of compressed air, and by that means the sale of equipment for compressed air use to use it in mining and construction industry.

By Mr. Benedict:

Q. Do they use compressed air in mining perlite? A. Yes, they do, they drill shot holes.

The Court: Well, what you are saying in effect, by virtue of counsel's question and your answer, is presumably then by way of inference, that this magazine is devoted to the stimulation of the use of compressed air in the many forms that compressor can be used, and one of the forms in which compressed air can be used is in the production of this so-called volcanic glass filter?

The Witness: Right.

The Court: Then in order to stimulate the production of volcanic glass, it has been suggested that there has been experimentation to the effect that volcanic 34 glass, when exploded, can be used for paint fillers, abrasives and filter aids, but in your experience as a chemist it can't

The Witness: That is right.

By Mr. Benedict:

Q. You might inform the Court as to the particular character of the items in which this item now appears. A. This journal contains articles by well known mining engineers that appears over their signature, and are identified.

The Court: I will take the distinction made by the witness. In other words, he is a chemist, and he has a magazine devoted to the engineering profession particularly with reference to the mining industry, and the particular article presumably, I draw the inference, is designed to stimulate the use of compressed air.

Mr. Benedict: And it is an anonymous article.

The Court: And the man who wrote it didn't know what he was talking about.

The Witness: That is right, and he isn't identified here.

The Court: That is putting it in the short vulgar way.

By Mr. Benedict:

Q. Are you familiar with the Chemical and Metal-
35 lurgical Engineering Magazine? A. Yes.

Q. I do not have a copy of that, but could you inform the Court briefly as to the general nature of that magazine, and the nature of the article that appears therein upon which the defendant is relying? A. Chemical and Metallurgical Engineering is a periodical published by a publishing house. It is not affiliated with any technical or scientific organization. It contains a very large amount of advertising, and this particular reference, like the one in Compressed Air, appears as a news item and is not identified with any particular authority in any field.

The Court: Well, now, may I interrupt? There is a little confusion here, and is something I am responsible for. The discussion we just had by way of question and answer, namely, as the result of experimentation since that time, that came from the July, 1945, Chemical and Metallurgical Engineering Magazine, not from Compressed Air Magazine.

Mr. Benedict: That is my fault, Your Honor. I was reading from the wrong article.

The Court: The Compressed Air Magazine relates to the business of 40-80 mesh, and the question of the examination under the microscope of the product indicated that it had certain properties of value, so we will take that all back, won't we? This is written presumably by
36 Chemical Engineer.

The Witness: However, in this Chemical Metallurgical Engineering it appears in a section that is not identified in any particular matter. It is in a series of news items. I don't know who the author is.

The Court: Who publishes the article? Who publishes the magazine, Chemical and Metallurgical Engineering Magazine?

The Witness: McGraw Hill.

The Court: I know McGraw Hill, McGraw Hill publish many magazines, but who is on the staff of engineers?

The Witness: It is McGraw Hill Corporation.

By Mr. Benedict:

Q. Do any scientific articles by recognized authority appear in Chemical and Metallurgical Engineering? A. Yes, they do, but when they do they appear under the signature of that person who is identified.

The Court: Let me ask you this: As a professional chemist do you subscribe to Chemical and Metallurgical Engineering Magazine?

The Witness: No, I don't. I used to.

By Mr. Benedict:

Q. To your knowledge does the item appearing in Chemical and Metallurgical Engineering entitled "Thermal Insulation from Perlite Rock," which contains a ref-
37 erence to suggested uses of exploded perlite, including filter aids, appear in a section similar to and devoted to the same purpose as that with which we had testimony regarding the item in the Compressed Air Magazine? A. It is the same in that it is in the section devoted to news items.

The Court: All right.

By Mr. Benedict:

Q. Dr. Leppla, have you—

Your Honor, in the interest of shortening these proceedings, I would like to show Dr. Leppla a chart which compares the two claims in suit and ask him to identify them.

The Court: There is only one claim in suit.

Mr. Benedict: The one claim in suit with the claims which were previously adjudicated in the parent application. I would like to have him identify them.

The Court: Well, that is not germane on the theory that res judicata is ruled out.

Mr. Miller: I think it is, Your Honor, because these claims are different, and all we have to decide is—

The Court: That is out of the case.

By Mr. Benedict:

Q. Dr. Leppla, have you prepared, and have you had experiments performed in connection with the preparation of filter aids falling within the terms of Claim 17 in
38 suit, and with other finely divided materials other than exploded perlite, which form above this—A. Yes, sir.

The Court: Mr. Benedict, I don't like to interrupt you, but we have been through that, the witness having made the distinction from Compressed Air and Chemical Metallurgical Magazine, Volume 52, and now I am wondering whether or not I might make a suggestion to you in the interest of chronology, if we could have the witness make a distinction, if he is the witness who is to do it, with reference to 19,166, before we get to the final claim?

We will take a recess for about ten minutes.

(Thereupon a short recess was had.)

Mr. Benedict: Your Honor, before we proceed to the Thatcher reference I should like to ask Dr. Leppla one or two questions about the two prior items we have been just discussing.

By Mr. Benedict:

Q. If you will refer to the Compressed Air item, Plaintiff's Exhibit 4, about three-fourths of the way or a little more from the bottom of the first column, what do you find there which might permit you to calculate the bulk density of the expanded perlite to which that article refers? A. It mentions 6½ to 7 times the original volume.

Q. And what would that mean in terms of bulk
39 density? What is the bulk density of perlite ore? A. Perlite ore has a bulk density of about 75 pounds per cubic foot.

Q. Do you refer to the raw rock or to the ore in some other form? A. That is the bulk density as it is crushed and screened, and ready to be popped.

Q. And with that figure can you make a calculation as to the bulk density of the expanded perlite discussed in the Compressed Air article? A. Yes. By dividing the 75 pounds per cubic foot by the 6½ or 7, it indicates that the bulk density of the expanded perlite would be about 11 to 12½ pounds per cubic foot.

Q. I hand you the Chemical Met. article—

The Court: What is the name of it, please?

Mr. Benedict: Chemical and Metallurgical Engineering Chemistry; and I ask you if you can make a similar calculation with respect to the exploded perlite discussed there.

The Witness: It indicates 6 to 10 times the volume, which corresponds to 7½ pounds per cubic foot to about 12½ pounds per cubic foot.

By Mr. Benedict:

Q. Are there any—he further makes the statement—I will withdraw that.

Those ranges are all in excess of the maximum limit set forth in the claim? A. Yes.

Q. Is that right? A. Yes.

Q. I refer you to the Thatcher patent, Plaintiff's Exhibit 6, entitled Filter Aid, and ask you if you are familiar with that. A. Yes.

Q. Will you please tell the Court if that patent discloses any material which is suitable as a filter aid? A. It discusses diatomaceous earth.

Q. And is diatomaceous earth suitable as a filter aid? A. Yes, it is the most common material used for filter aid.

Q. As of the time of the Thatcher patent, and as of the time of the other two items of the art relied upon by the Patent Office, was there any material of inorganic origin that was known to be a filter aid besides diatomaceous earth? A. No, it was the only filter aid.

Q. As of today do you know of any material, aside from
diatomaceous earth or the perlite produced by the process
we have here, of inorganic origin that can be made
41 into a filter aid, or that is a filter aid in its natural
state? A. These are the only two materials that
are widely sold as filter aids.

Q. Are there any inorganic materials that you know of that can be converted to filter aids by grinding or any other process? A. No.

Q. I note a reference which appears just below the table on the second column of page 1 to decolorizing processes in which materials such as carbons, charcoals, fuller's earth and decolorizing clays are used.

Are these materials used in finely divided form industrially? A. Yes.

Q. For what purpose? A. They are used as adsorbent.

Q. Are they filter aids in the sense that that term is defined in the specification in suit? A. No.

Q. They are not? A. No.

Q. They speak of decolorization in here and you spoke of
the adsorbent. Will you explain to the Court the difference
between this term and what the function of a
42 filter aid is? A. The materials that you have just
mentioned as an absorbent are used for the removal
of the material that is dissolved in the solution, whereas
filter aids are used for the removal of materials suspended
in solution by mechanical operation.

Q. I refer you to the first column of page 2—I am sorry. I refer you to the first column of page 2 beginning at line 18 and read you as follows:

"I have found that when inorganic solid materials adapted for manufacture of filter aids, such as diatomaceous earth," and this is parenthetical "otherwise known as kiesel-guhr, tripoli, fossil flour, infusorial earth, or molar, whether calcined or uncalcined, are so disintegrated," and so forth.

Do these terms all refer to the same material that you testified, diatomaceous earth? A. Yes, they are all synonyms for the same material.

Q. Is there any other material disclosed in the Thatcher patent that would come within the term:

"When inorganic materials adapted for manufacture of filter aids"—

are there any other materials disclosed in there except diatomaceous earth or these five or six synonymous words that are suitable for the manufacture of filter aids? A. None.

43 Q. I refer you to the second column beginning at line 9—I am sorry, line 5—where it states:

"Indiscriminate grinding of a filter aid such as, for example, diatomaceous earth, does not produce a filter aid which is capable of giving a high rate of flow and clarity in the resulting filter aid."

Now I ask you, Are the materials that Thatcher is dealing with, which he grinds to produce filter aids, filter aids in their natural state? A. Yes, they are.

Q. What is the purpose of his grinding? A. He is taking the material that is a filter aid, and by grinding and sizing he is improving its performance to make a better filter aid of it.

Q. I believe you testified that exploded perlite in the exploded state is not a filter aid? A. Right.

Q. Do you have any knowledge from these references, or elsewhere, of taking a material, raw material which is not a filter aid in the form it occurs, and converting that into a material which is a filter aid? A. No.

The Court: A filter aid, if I understand it correctly, is used primarily to remove material suspended—

44 The Witness: That is right.

The Court (continuing): —in a solution, and you make that distinction against other things of a related character, similar.

The Witness: Yes.

The Court: Used to remove solid material?

The Witness: Dissolved material.

The Court: Dissolved material?

The Witness: Yes.

The Court: Now, I want you to refresh my recollection with reference to suspended matter, matter suspended in a solution. In other words, you have a clear solution, but it is apparent to the eye, is that right?

The Witness: If it is suspended material it is visible. In other words, that is like muddy water, and material that can be separated from the pure water by filtration, whereas dissolved material, say like pure sugar dissolved in water, it cannot be removed by filtration.

The Court: So therefore the filter aid is designed to remove suspended material?

The Witness: That is right, and only that. That is all it does.

By Mr. Benedict:

Q. How do you remove these carbons, fuller's earth, and such material as mentioned by Thatcher as used for decolorization from the solution in which they appear? A. They are removed by filtration.

Q. Do you use a filter aid in so removing these? A. Yes. In very many cases it is necessary to use a filter aid to remove these adsorbent materials.

The Court: May I ask for the record, Dr. Leppla, what has been your training?

The Witness: I have a bachelor, master's and doctor's degree in chemistry from the University of Illinois.

By Mr. Benedict:

Q. Dr. Leppla, you have stated that you know of no other materials except—no other inorganic materials except diatomaceous earth and expanded perlite manufactured by the process set forth in the claims which are filter aids; and materials of that kind are not filter aids? A. No, they are not.

Q. What would you say are the two principal characteristics requisite of the material to produce an effective

filter aid? A. By far the most important characteristic is the shape of the individual particles. It is necessary in a filter aid to have particles of very irregular shape, so that when they are packed together in filter cakes, the resulting cake is very open and porous, and a good filter aid will
form a cake that is about 85 to 90 percent open,
46 vacant space, whereas most solid materials, in fact
almost everything except diatomaceous earth and perlite, form a much denser cake where the void volume may be 25 or 30 percent.

Q. And technically what is diatomaceous earth? A. It is a silica material, the skeletons of tiny little algae that lived hundreds of thousands and millions of years ago.

Mr. Benedict. Your Honor, it might be helpful to you if we put in an exhibit, a photograph of diatomaceous earth.

By Mr. Benedict:

Q. Dr. Leppla, I hand you a photograph and ask you if you can identify it. A. Yes. This is a photomicrograph of diatomaceous earth filter aid.

Mr. Benedict: I offer this as Plaintiff's Exhibit No. 7.

Mr. Miller: No objection.

(Thereupon photograph of diatomaceous earth was by the Court received in evidence as Plaintiff's Exhibit No. 7.)

By Mr. Benedict:

Q. When you speak of—

May I borrow that a minute, Mr. Miller? I am
47 sorry, I only have the two.

What are these shapes and figures that you see in there in this photomicrograph, Exhibit 7? A. Well, there are a great variety of different shapes and forms of diatoms. In fact, there are supposed to be 10,000 different species. Some of these are needles, some are flat discs, and one over in the right-hand corner is shaped somewhat like a boat, but the important characteristic is the fact that there are a great many different types, forms, shapes and sizes.

The Court: What are these specifically, skeletons of these minute organisms you spoke about?

The Witness: Yes, silica skeletons.

By Mr. Benedict:

Q. When that diatomaceous earth, as you have in the photograph, is ground, as in Thatcher, is there any fundamental physical change in the diatoms composing the material? A. No. Some of the larger ones will be broken in half, fragmented, but still have the typical diatomaceous earth structure, a great variety of shapes and forms, but still form a filter cake consisting almost entirely of void space.

The Court: Well, is there a certain uniformity of structure with reference to perlite?

Mr. Benedict: Your Honor, I think I can help
48 you on that.

The Court: You have explained that one of the difficulties from the standpoint of perfection of use of diatomaceous earth as a filter aid is presumably due to the tremendous variety of forms involved.

The Witness: That is an advantage. That is what contributes to the fact that they do not pack very well together.

The Court: Then what is the distinction? What is the advantage of the use in over this?

The Witness: For the most part there is no advantage, it is alternate material.

The Court: Well, then this is not helpful except insofar as it reads on the record.

Mr. Benedict: I want to show you for your own information, Your Honor, the difference in the general structure of the diatoms, and the difference in the expanded perlite and the structure of the perlite filter aid itself.

The Court: Yes, but Mr. Miller of the Patent Office has cited this patent and the particular language in it, reading from Patent No. 19,166, second column, first page:

"I have found that this may be obtained by preparing a filter aid having particles ranging in sizes from a relatively
coarse particle to very fine, in such proportions that
49 they do not form a mass of maximum density upon
the filtering surfaces of the filtering apparatus."

And it has been cited, I assume, to indicate to the person skilled in the art, on reading this would actually be aided in experiments of a similar character and dealing with related matter, and the related matter in this particular instance being perlite. Is that the point?

Mr. Miller: Right, Your Honor.

Mr. Benedict: Well, Your Honor, also the witness has testified that there are other materials that he discloses in there which are used in finely divided form for decolorizing purposes which have no filter aid properties whatever, even though he uses this in the same sentence, the fact of the matter is that he is using the term filter aid, in a rather loose sense.

Perhaps if Dr. Leppla testified in regard to this a little bit it might clear it up in your mind.

The Court: Oh I think the doctor has cleared it up in my mind, except I do not want to be confused. I understood that this use of perlite, this so-called volcanic glass has been known for a long time. Is that right?

The Witness: No sir, Exploded perlite—

The Court: Now, exploded perlite, and expanded perlite, you make a distinction between them?

The Witness: No, I am sorry. They are the same thing, popped, exploded, expanded.

50 The Court: I thought you made a distinction between exploded perlite and expanded perlite. All right.

The Witness: The fact that perlite could be expanded was not known before about 1941. The fact that it could be converted into a filter aid was not known—

The Court: Well, it comes down again, we don't want to get off the track, to the critical manner in which it can be used.

Mr. Benedict: Your Honor has that exhibit. I think we can save time by simply putting in the exhibit.

The Court: Really, I would rather not have it because it doesn't help me. I am not an expert in the field so therefore I would rather not have anything that was going to be confusing. I don't say that it will by virtue of the explanation made here now, but I would rather have you address yourself to the critical aspect of the matter that is before me and indicate how the references as cited do not apply. Now don't misunderstand me, you can have it any way you want it from the standpoint of the record.

Mr. Benedict: Yes. Well, I would like to have you refer in your further consideration of the plaintiff's case to photographs marked Plaintiff's Exhibit 3-A, which is a photomicrograph of expanded, that is of perlite filter aid, not the expanded perlite, but perlite filter aid.

The Court: Now, will you make a proffer as to
51 why you are offering these?

Mr. Benedict: Well, these are actually in the record in the case in suit, and they are offered purely for comparative purposes for Your Honor to see the difference in the shapes of these two.

The Court: Well, that is the point. That is the reason I asked Dr. Leppla the question, How critical is the difference in shape? That is why I asked that question.

The Witness: That is the whole thing.

The Court: All right. Then if you will address yourself to that you will resolve my difficulty and help yourself.

By Mr. Benedict:

Q. What are the desirable shapes that you know of for filter aids?

I will ask this question: Are spherical or cubical shapes desirable for filter aids? A. No, they are the least desirable of all forms.

Q. What are the nature of the shape of the particles of material appearing, or mentioned in the Thatcher patent other than diatomaceous earth when ground to a fine size? A. You mean carbon?

Q. Carbon, fuller's earth. A. Those materials are largely spherical in shape.

The Court: I think you have explained it in your 52 reference to the case.

The Witness: The point is that expanded perlite is the spherical form.

The Court: And has more air space, so to speak?

The Witness: That is right.

The Court: All right.

By Mr. Benedict:

Q. I refer you to the table entitled "Bulk and Cake Densities of Aggregates" and ask you if you can identify that. A. Yes. This is a summary of some experimental work performed in our laboratory.

The Court: In other words, Doctor, is it by virtue of the variegated shapes and the total aggregate of the cake, so to speak, plus the tremendous amount of air space that gives the filter aid its utility?

The Witness: That is right.

By Mr. Benedict:

Q. Will you tell the Court what the—you have identified this—

I offer this in evidence as Plaintiff's Exhibit 8.

Mr. Miller: No objection.

(Table of Bulk and Cake Densities of Aggregates was by the Court received in evidence as Plaintiff's Exhibit No. 8.)

The Court: And it is by use of the processes set 53 forth in 17 that results in the fineness of utility, so to speak?

The Witness: Yes.

By Mr. Benedict:

Q. How were these experiments carried out, Dr. Leppla? A. We took some exploded, expanded perlite having a density of 3.3 pounds per cubic foot, and ground it in a laboratory mill to a certain particle size, as indicated in the second vertical column, and did identically the same thing with three other samples of expanded perlite, having respectively 5.3, 8.5, and 14.0 pounds density. Then we measured the filter cake density that resulted from those four starting materials, and the results are set forth in the third verticle column.

Q. And what do you conclude from the results set forth there in the third column as to the cake density? A. It indicates that the filter cake density is directly related to the density of the starting aggregate, and that a density of 5.3 or less in the aggregate will result in a filter aid having a cake density of 25 pounds or less.

Q. What does it represent insofar as a higher bulk density starting material is concerned? A. It indicates if the density is 8.5 or more that the resulting filter aid
density will be 36 pounds or more, which is outside
54 the range of commercially usable filter aid.

Q. And what about is the upper limit or range of materials which are commercially useful, what density, cake densities of filter aids useful commercially? A. Filter aids sold commercially range in filter cake density from about 15 to about 22 pounds per cubic foot.

The Court: Now, would you distinguish again for me the difference between bulk density and cake density so I will have the distinction? Bulk density, as I understand it, is measured in pounds.

The Witness: It is measured by taking a cubic foot box and shoveling the material in.

The Court: Then you have the filter aid cake density after you go through the process?

The Witness: Right.

The Court: Now, what does that represent, cake density?

I know what you mean by the cake as we have discussed that here. Now, what do you mean by cake density? Is there a difference?

The Witness: Yes, we haven't explained that.

The Court: All right.

By Mr. Benedict:

Q. I think you should explain that. A. The way we measure that in the laboratory is to take a given weight of filter aid and suspend it in water, stir it up and
55 pour it through a filter, and then we measure after filtration is completed, the volume occupied by that cake, and divide the volume by the weight and we have the pounds per cubic foot.

Q. Then from this table, what would you say with respect to the criticality of the upper limit of 6 pounds per cubic foot in the starting aggregate called for by the claim in suit? A. These data indicate a material having, an expanded perlite having a bulk density of above 6 pounds per cubic foot, cannot be converted into a filter aid having a cake density in the useful range.

The Court: Then what is the density of the useful range, around about 22 to 24?

The Witness: It would be about that, yes.

By Mr. Benedict:

Q. Dr. Leppla, I hand you a chart entitled "Properties of Filter Aids used in Charts A and B" and ask you if you can idenitfy that. A. Yes. This is a summary of data on some samples prepared and used in filtration tests.

Q. Are all of those samples substantially the same in order of particle size? A. For all practical purposes the three samples, one, two and three, have identically the same particle size.

56 Mr. Benedict: I offer this exhibit as Plaintiff's Exhibit 9.

Mr. Miller: No objection.

(Chart entitled Properties of Filter Aids used in Charts A and B was by the Court received in evidence as Plaintiff's Exhibit No. 9.)

By Mr. Benedict:

Q. I refer you to a chart entitled "Comparison of Product of the Invention with —40 +80 Mesh Milled Expanded Perlite," and ask you if you can identify that? A. Yes, that is a graphical representation of some filtration tests.

Mr. Benedict: I offer this chart, a photostatic copy of this chart, with Mr. Miller's leave, as Plaintiff's Exhibit 10.

Mr. Miller: No objection.

(Chart entitled Comparison of Product of the Invention With —40 +80 Mesh Milled Expanded Perlite was by the Court received in evidence as Plaintiff's Exhibit No. 10.)

By Mr. Benedict:

Q. Will you explain briefly, are the samples that were used in this chart the ones you referred to in Exhibit 9? A. I don't believe they were.

Q. Oh, I am sorry. Are any samples there used
57 there? A. Yes, the first sample is common to both.

Q. And what does the sample represent which has the Roman numeral IV? A. That is the material of the Compressed Air reference.

Q. How is it manufactured? A. It is manufactured by expanding perlite and then crushing, and screening out this particular size fragment.

Q. Which would be ground 40 to 80 mesh material? A. That is right.

Q. Will you explain the experiment shown in Column marked 5 and the meaning thereof? A. The three bars to the left represent the filtration results obtained with Sample No. 1, the material of our invention.

Sample No. 4, the material of Compressed Air reference.

Sample No. 5 with no filter aid or any other material added.

The black bar indicates the actual volume of filtrate discharged from the filter in a standard 21-minute test.

The material of the invention developed a flow of about 3,000 millimeters of material. The Compressed Air reference over Roman IV, developed a flow much less than
that, approximately 800 millimeters, and the mate-
58 rial, the volume discharged in the absence of any
added material, something more than that, about
1200 millimeters.

Q. What do the overall columns above lines 4 and 5 indicate? A. The total length to the top, including the shaded section, includes the calculated volume that would be delivered in a 4-hour period, which is the commercial filtration cycle.

Q. That is an extrapolated value? A. Yes.

The Court: That is a what?

Mr. Benedict: Extrapolated.

The Court: Extrapolated?

Mr. Benedict: Yes.

Mr. Miller: Spell it, please.

Mr. Benedict: E-x-t-r-a-p-o-l-a-t-e-d.

The Court: That is a word of art. What does it mean?

The Witness: It means an extended value. We actually measure the results in 21 minutes at several different intervals, at the end of 3 minutes, 6 minutes, 9 minutes, and so forth, and then we draw those results on a special form of chart, and draw a straight line through them and extend it up to predict what the actual flow would be in a
longer period, such as a 4-hour period.

59 The Court: I am concerned with the derivation
of the word.

The Witness: Extrapolated? I am not a good enough philologist.

The Court: Well, I will address myself to that later.

By Mr. Benedict:

Q. Is that method of predicting the utility of a filter aid over extended periods of time accepted in the industry? A. Yes, it is very commonly used.

Q. Are the tests by which these data were obtained, standard tests that are generally accepted in the industry? A. Yes.

Q. Are they used for research purposes in the evaluation of filter aid materials? A. Yes.

The Court: Now this is addressing itself, I take it, specifically to the reference in the Compressed Air Magazine?

Mr. Benedict: That is correct.

The Court: All right.

By Mr. Benedict:

Q. The first column to which you referred, Column No. 5,
was entitled Palos Verdes Tap Water. Is that a
60 particularly difficultly filterable system? A. No,
that is the city water supply in the location in which
our laboratory is located.

Q. Does it have high solid content? A. No, it has very low solid content.

Q. I refer you to Column 6, Long Beach back-wash water, and ask you what that is. A. That is a sample of water obtained from the Long Beach municipal water treatment plant. It represents the relatively impure water obtained by back-washing or purifying with regular sand filters. It contains an extra concentration of suspended material. It is a somewhat more difficult material to filter.

Q. And what would your conclusion be with respect to the effectiveness of the filter aid manufactured according to this invention, which I believe is No. 1, the 40 to 80 mesh milled expanded perlite No. 4, and the blank, that is where no filter aid was used No. 5. A. These data indicate to me that Sample No. 1 is a good filter aid.

Sample No. 4 is no filter aid at all in that it gives less flow than would be obtained in the absence of any added material.

Q. Briefly, I refer you to Column 7, Suspension of activated carbon in water, and you used the same
61 three samples there. What are your conclusions with respect to that? Do they agree with the conclusions given? A. Essentially the same, and Sample No. 8, the oil well waste water.

Q. And are your conclusions with regard to that essentially the same as the other? A. Yes.

Mr. Benedict: If you would like any more inquiry, I am trying to save as much time as possible, Your Honor, and still get the material in.

By Mr. Benedict:

Q. Based upon that, what is your conclusion with regard to the exploded perlite ground to 40 to 80 mesh size in the filtration of water under the conditions employed when using filter aids, as that term is defined in the application in suit? A. My conclusion is that 40 to 80 mesh material is not a filter aid.

Q. I refer you to a chart bearing the caption "Effect of Aggregate Density on Flow Rate of Perlite Filter Aids."

This, Your Honor, will also be directed directly to the criticality of the 1 to 6 pound limitation of the claim.

Did you have this chart prepared? A. Yes.

62 Q. And from what was it prepared? A. It was prepared from some experimental work performed in our laboratory in the past six months.

Mr. Benedict: I offer a photostatic copy of this chart as Plaintiff's Exhibit 11.

Mr. Miller: No objection.

(Thereupon Chart entitled Effect of Aggregate Density on Flow Rate of Perlite Filter Aids was by the Court received in evidence as Plaintiff's Ex. No. 11.)

By Mr. Benedict:

Q. Will you explain to the Court the three samples which are represented in the various columns here? A. The sample marked Roman I is material, according to the claim of the invention of an aggregate bulk density of 2 pounds per cubic foot.

Sample No. 2, three and a quarter pounds per cubic foot aggregate.

Sample No. 3 produced from 8 pounds per cubic foot, outside our 6-pound range.

The bars are very much the same as in our previous chart.

Q. Would the 8-pound aggregate correspond to a bulk density falling within the range disclosed in the Compressed Air article? A. The Compressed Air
63 article was 6½ to 7 volume expansion, that is 11 to
12½ pounds per cubic foot—no, it is outside the range.

Q. It is below it? A. Yes.

Q. And would it correspond to a filter coming within—not a filter aid, I am sorry. Strike that.

An aggregate of expanded perlite coming within the range of the Chemical Metallurgical Engineering item? A. Yes. As I remember that, it was 6 to 10 volume, and the lower limit was 7 to 10 pounds per cubic foot.

Q. And the three filter aids shown there correspond to, or have the properties of Plaintiff's Exhibit 8? A. Yes, those are the same materials.

Q. Will you explain to the Court what Irish Sea moss is, and whether it represents a commercial filtration problem? A. Yes. The material designated Irish Sea moss is obtained by taking the dried, green Irish Sea moss and cooking it with water for several hours at a high temperature. Part of the material dissolves and forms the material which is purified and used and sold as carrageen. Most of the material does not dissolve and must be separated from the solution by filtration. We have a number of customers who perform this operation commercially.

Q. What is the character of the suspended
64 material that must be removed? A. It is un-
extracted sea moss, very gelatinous, and extremely
difficult to filter.

Q. And briefly I believe you testified Samples No. 1 and 2 are within the claim, and Sample No. 3 is outside of it. What do you conclude from the column entitled Irish Sea moss with respect to the effectiveness of these filter aids? A. 1 and 2 are much more effective than 3.

Q. I turn to Column 2 marked orange pectin, and ask you to explain to the Court what those experiments were, how orange pectin is made, and what the filtration problem there is. A. The problem there is to remove the suspended material from crushed extracted oranges in the production of purified pectin used in making jelly, ice cream and other food products.

Q. It is a commercially encountered product? A. Yes, we have customers in California that operate that process.

Q. And what do the results show with respect to the three, two falling within the range and one falling above. A. The length of the bars indicate that 1 and 2 are more suitable than 3.

Q. I refer you to the third column marked 60 percent
brix sugar, and ask you to explain what that is.
65 A. That is a material obtained by dissolving raw
sugar in water at a concentration of about 60 per-
cent by weight. It is the most common filtration operation performed by using filter aids.

Q. Will you briefly tell the Court what your conclusions are with respect to the three materials identified as 1, 2 and 3 in the group of experiments? A. 1 is more effective. 2 is somewhat less effective, and 3 is much less effective than 1 or 2.

Q. I refer to Column 4 marked 60 percent brix sugar, and I refer you particularly to the portion of the chart

By Mr. Benedict:

Q. Will you explain to the Court the three samples which are represented in the various columns here? A. The sample marked Roman I is material, according to the claim of the invention of an aggregate bulk density of 2 pounds per cubic foot.

Sample No. 2, three and a quarter pounds per cubic foot aggregate.

Sample No. 3 produced from 8 pounds per cubic foot, outside our 6-pound range.

The bars are very much the same as in our previous chart.

Q. Would the 8-pound aggregate correspond to a bulk density falling within the range disclosed in the Compressed Air article? A. The Compressed Air
63 article was 6½ to 7 volume expansion, that is 11 to
12½ pounds per cubic foot—no, it is outside the range.

Q. It is below it? A. Yes.

Q. And would it correspond to a filter coming within—not a filter aid, I am sorry. Strike that.

An aggregate of expanded perlite coming within the range of the Chemical Metallurgical Engineering item? A. Yes. As I remember that, it was 6 to 10 volume, and the lower limit was 7 to 10 pounds per cubic foot.

Q. And the three filter aids shown there correspond to, or have the properties of Plaintiff's Exhibit 8? A. Yes, those are the same materials.

Q. Will you explain to the Court what Irish Sea moss is, and whether it represents a commercial filtration problem? A. Yes. The material designated Irish Sea moss is obtained by taking the dried, green Irish Sea moss and cooking it with water for several hours at a high temperature. Part of the material dissolves and forms the material which is purified and used and sold as carrageen. Most of the material does not dissolve and must be separated from the solution by filtration. We have a number of customers who perform this operation commercially.

Q. What is the character of the suspended
64 material that must be removed? A. It is unextracted sea moss, very gelatinous, and extremely difficult to filter.

Q. And briefly I believe you testified Samples No. 1 and 2 are within the claim, and Sample No. 3 is outside of it. What do you conclude from the column entitled Irish Sea moss with respect to the effectiveness of these filter aids? A. 1 and 2 are much more effective than 3.

Q. I turn to Column 2 marked orange pectin, and ask you to explain to the Court what those experiments were, how orange pectin is made, and what the filtration problem there is. A. The problem there is to remove the suspended material from crushed extracted oranges in the production of purified pectin used in making jelly, ice cream and other food products.

Q. It is a commercially encountered product? A. Yes, we have customers in California that operate that process.

Q. And what do the results show with respect to the three, two falling within the range and one falling above. A. The length of the bars indicate that 1 and 2 are more suitable than 3.

Q. I refer you to the third column marked 60 percent brix sugar, and ask you to explain what that is.
65 A. That is a material obtained by dissolving raw sugar in water at a concentration of about 60 percent by weight. It is the most common filtration operation performed by using filter aids.

Q. Will you briefly tell the Court what your conclusions are with respect to the three materials identified as 1, 2 and 3 in the group of experiments? A. 1 is more effective. 2 is somewhat less effective, and 3 is much less effective than 1 or 2.

Q. I refer to Column 4 marked 60 percent brix sugar, and I refer you particularly to the portion of the chart which bears along the side the notation "Gallons per square foot per 2 hours," and ask you what that refers to? A. That is a recalculation of the material under No. 3 in terms of commercial use of gallons per square foot of filter area.

Q. And is that an important consideration in the filtration problems? A. It is very important in that it determines how large a filter a given customer needs to perform his regular daily production operation.

Q. I refer you to the box in the upper right-hand corner entitled "Filter area needed to filter 1,000 G.P.H." I presume that is gallons per hour? A. Right.

66 Q. Will you explain in terms of each of these filter aids whether—

The Court: Now I assume with reference to Column 1, that is 38.6 square feet?

The Witness: Yes.

The Court: Column 2, 49.1 square feet and Column 3 would be 94 square feet?

The Witness: That is right.

By Mr. Benedict:

Q. Now, Dr. Leppla, I also refer you again to Exhibit 8, and the column at the right-hand side marked "Yield percent," there is a value appearing after each one of those three samples, 1, 2 and 3, that were used in the experiment you have just described.

Will you tell me what this column purports to show? A. These figures represent the actual weight percent of usable filter aid produced from the starting expanded perlite, that is, Sample No. 1, 2-pound aggregate, 95 percent of useful filter aid is recovered from the starting material in the operation.

Q. In other words, for a ton of expanded perlite, cellular perlite, having a density of 2 pounds per cubic foot, you can obtain 90 percent or more of filter aid falling within the range here? A. Yes, that is right.

67 Q. What is the case with the 8-pound starting aggregate which falls outside the range given in the claim? A. The recovery is only 47 percent, so that twice as much starting material is required.

Q. In other words, were these experiments conducted each with the same amount of filter aid? A. Yes.

Q. So that your conclusion, if I understand it, is if you were using one ton of ore you would receive in the neighborhood of one ton of filter aid here? A. At 90—

Q. In the case of the two pounds, in the case of 8 pounds, two tons of ore would produce the same? A. Yes, that is right.

Q. That is the right conclusion? A. Yes.

The Court: Let me ask you, Mr. Benedict, is Dr. Leppla your last witness?

Mr. Benedict: I might say, Your Honor, I have almost asked my last question.

The Court: That is fine. Then we might finish.

Mr. Benedict: I think it will not take more than five minutes, ten at the most.

Mr. Miller: Well, I don't know, Your Honor, I haven't had any cross examination.

68 By Mr. Benedict:

Q. What would you conclude in terms of practical utility as to the two filter aids marked say 1 and 3? A. I would say from the practical point of view 3 would be unsuitable for commercial operation in that raw material costs would be higher, the cost of operating the manufacturing plant would be higher, and then after the product had been manufactured it would be much less suitable and would be, in present times, unsalable.

Q. Would it require a larger filter area? A. If it were used commercially it would require the customer to install additional filtration equipment to augment their present supply.

Q. Is that expensive? A. Very expensive.

Mr. Benedict: Your witness.

Cross Examination

By Mr. Miller:

Q. You stated, did you not, that you were employed by the plaintiff in this suit? A. Yes, sir.

Q. Then you have an interest, I suppose, do you not, in the outcome of this suit? A. Yes.

Q. You were testifying about the publication,
69 Chemical Metallurgical Engineering. That describes, does it not, exploded perlite which has a weight per cubic foot anywhere from just a few pounds up to 10 pounds per cubic foot? A. Yes, but in the same sentence it has conflicting statements.

Q. But it does say that he makes material which weighs between those limits, does he? He says that? A. Yes.

Q. And he further says that it varies, does he not, depending upon the method and temperature of the explosion? A. Yes.

Q. Now you, as a chemist, wouldn't have any trouble in view of the fact that the temperature and method of treating it enters into it, you wouldn't have any trouble, would you, in making a heavy product or a light product if you wanted one light or heavy? A. Within certain ranges, yes, sir.

Q. This same publication states, does it not, that the suggested uses of exploded perlite include filter aids? It says that, doesn't it? A. Yes.

Q. Now, you do not intend to imply by your testimony, do you, that exploded perlite cannot be used as a filter aid? A. Yes, sir, I do.

70 Q. Have you read the application in suit? A. Yes, sir.

Q. Have you looked at the file on it? A. I haven't seen it for a long time.

Q. That file says, "Perlitic mineral filter aids," doesn't it? A. Yes, sir.

Q. And that application sort of indicates that perlitic mineral can be used as a filter aid, doesn't it? A. After proper processes, yes.

Q. Ah, after proper processes. Now, what does one have to do to that to make it a proper filter aid? A. By starting with the proper raw materials and milling, as described in our Claim 17, will be converted into a useful commercial filter aid.

Q. And referring then to Claim 17, the weight given in that claim is shown as 1 to 6 pounds per cubic foot? A. Yes, sir.

Q. And the article I was just quizzing you about disclosed that you could use perlite from a few pounds up to 10 pounds, did it not? A. Yes.

71 Q. Now, you indicated that the material had to be ground in order to be properly— A. Yes.

Q. You were testifying about this other publication where it said to grind it to 40-80 mesh, you indicated a 40 to 80 mesh didn't make a very good filter? A. It doesn't make a filter aid at all.

Q. But you were also testifying about it.

Now, he certainly teaches, doesn't he, that the effectiveness of the filter aid is increased by grading the particles between certain ranges and sizes which he specifically gives? A. He teaches only diatomaceous earth sizes in those ranges.

Q. Yes, but he teaches that just taking diatomaceous earth of any size, but he teaches that if you grade the particles you get better than if you didn't grade it, doesn't he? A. That is right.

Mr. Miller: That is all.

Redirect Examination

By Mr. Benedict:

Q. Dr. Leppla, what is the character of the ground 40 to 80 mesh material Mr. Miller was referring to in the Compressed Air article, is it cellular? A. Yes, it is cellular.

Q. Was the grinding carried out in that article to
72 a sufficient degree to destroy the cellular particle?
A. It was not.

Q. Does he give any teaching whatever with respect to what to do with the material that is finer than 80 mesh? A. No, on the contrary he did nothing with it.

Plaintiff's Exhibit No. 1

Liber K241 Page 134

ASSIGNMENT

This Assignment Witnesseth, That Whereas, John W. Kenney, Jr., a citizen of the United States, residing in the City of Long Beach, County of Los Angeles, and State of California, and Armand R. Bollaert, a citizen of the United States, residing in the City of Arcadia, County of Los Angeles, and State of California, have invented certain new and useful improvements in Perlitic Mineral Filter Aids for which they are about to file application for Letters Patent of the United States; and

Whereas, Great Lakes Carbon Corporation, a Corporation organized and existing under and by virtue of the laws of the State of Delaware, and having a principal place of business at 18 E. 48th St., New York, New York, is desirous of acquiring an interest in and to said invention, and in and to the Letters Patent of the United States that may be issued thereon;

Now Therefore, To All Whom It May Concern:

Be It Known, that for and in consideration of the sum of One ($1.00) Dollar in hand paid, and other good and valuable considerations, the receipt of which is hereby acknowledged, the said John W. Kenney and Armand R. Bollaert do hereby transfer, set over and assign unto said Great Lakes Carbon Corporation, its successors and assigns, the entire right, title and interest in, to and under said application for Letters Patent, and the invention covered thereby, and the resultant patent or patents thereon, or any renewals, reissues, extensions, substitutions, continuations or divisions thereof, including all foreign rights, thereunder, as fully set forth and described in the specification prepared and executed by them of even date, to-wit: July 19, 1951, preparatory to obtaining Letters Patent of the United States thereon.

And they hereby authorize and request the Commissioner of Patents to issue said Letters Patent in accordance with this Assignment, to the said .... its successors and assigns.

IN WITNESS WHEREOF, they have attached their hands and seals at Arcadia, Calif., this 19th day of July, 1951.

ARMAND R. BOLLAERT (SEAL)
JOHN W. KENNEY, JR. (SEAL)

State of California }
County of Los Angeles } ss.

Before me, a Notary Public in and for the County and State aforesaid, personally appeared JOHN W. KENNEY, JR. and ARMAND R. BOLLAERT, to me personally known, who duly acknowledged that they signed, sealed and delivered the foregoing instrument as their free and voluntary act and deed, and for the uses and purposes therein set forth.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my notarial seal this 19th day of July, 1951.

C. R. NICHOLS
(SEAL) *Notary Public in and for the*
County of Los Angeles
State of California

My Commission Expires Apr. 21, 1952

Plaintiff's Exhibit No. 2

HISTORY OF
APPLICATION SERIAL NO. 241,398
KENNEY AND BOLLAERT

Filed: August 11, 1951
For: Perlitic Mineral Filter Aids

This invention relates to finely comminuted mineral agents for use in the clarification of turbid liquids by filtration, and specifically to filter aids prepared from minerals which have been artificially heat expanded to a cellular structure and low bulk density.

This application is a continuation-in-part of our co-pending application, Ser. No. 688,430, filed August 5, 1946 for Light Weight Mineral Filter Aids.

As is well known, mineral (diatomaceous earth) filter aids are used for removing finely divided, colloidal and/or mucilaginous suspensoids from liquids. Such filter aids are chiefly used by admixing very small proportions of the finely powdered filter aid with the liquid and thereafter filtering the liquid through a medium (screen, cloth or other readily permeable support) on which the filter aid and entrained suspensoids are retained while the liquid passes through in a state of clarity. Alternatively, or in conjunction with the practice just described, a precoat of filter aid may be built up on a filtration apparatus (i.e. rotary or plate and frame filter presses) and the liquor passed through it to remove the undesirable suspended matter.

To be fully effective in any given instance, a filter aid must entrain and retain the greatest possible proportion of the suspensoids originally present in the liquid, and must form on the filtering medium a cake which is as freely permeable as possible to the flow of the clarified liquid. For convenience these more or less incompatible characteristics are measured as "relative clarifying value" and "relative flow rate" respectively. The extent to which these two characteristics are developed determine the utility and value of the filter aid for any given use.

Other factors being equal, we have found that the flow rate shown by a filter aid increases and the clarifying value decreases as the average particle size is increased. The "other factors" referred to include the viscosity of the liquid at filtering temperature and the nature and dimensions of the suspended particles, which are conditions of the problem and uncontrollable, and the particle size distribution of the filter aid, which is controllable and which may be so controlled as to improve materially the relation of flow rate to clarifying value. This improvement is one of the objectives of the present invention.

By reason of the widely different characters of the various turbid liquids to be clarified and of the suspensoids which produce this turbidity, it is necessary to provide a series of filter aids of varying average particle size and varying flow rate. In this series the member having the highest flow rate will have the least clarifying power and will be adapted to use in instances in which the suspensoids, by reason of their coarseness and freedom from gummy substances, are relatively easy to remove. At the other end of the series will be a member showing a low flow rate but capable of removing colloidal and mucilaginous suspensoids which would pass more or less freely through filter cakes of the highest flow rate material.

The term "filter aid" as used herein and in the appended claims is intended to include materials adapted to the foregoing filtration operations. These types of filtration are sharply and clearly distinguished from that of a percolation bed, in which sand, fullers earth or other granular material is formed into a relatively thick layer through which the liquid to be clarified is passed without previous addition of solids. In this connection others have proposed to utilize artificially expanded minerals of the perlite type, and also natural pumice, in the filtration of water. More specifically, it has been proposed to prepare a —40 +80 mesh fraction of expanded perlite by crushing an aggregate of comparatively large particle size and selecting a —40 +80 mesh fraction for water filtration. As will be subsequently fully developed herein such a material is foreign to the products of the present invention both with respect to its physical properties and its efficiency as a filter aid (in the sense that the term is used herein). The mechanics of the two operations are wholly different, and correspondingly different solid agents are required.

The primary object of the invention is to produce from artificially expanded perlite and minerals of the perlite type, and in some instances from certain minerals which occur in nature in a partially expanded condition, a series of filter aids having various defined relations of particle size, flow rate and clarifying power.

Further object of the invention is to produce from the minerals herein described a series of filter aids which are comparable in flow rate and clarifying power to various commercial grades of diatomaceous earth filter aids.

In the present description and in the appended claims the term "perlitic" or "perlite" is used for convenience to embrace a variety of minerals of closely related properties, including perlite, pumicite, obsidian, pitchstone, vitrophyre, certain forms of heat expandable volcanic ash and pumice and generally any volcanic glass containing bound water as contrasted with free water (that water which is removable on heating the mineral at 100-105° C.).

When minerals of the type listed above are heated to a temperature at which they soften or become plastic without fusing (i.e. 950-1260° C.) they expand suddenly and become finely cellular or vesicular and very light in apparent density. This expansion is believed to be due to the evolution or volume increase of vapor from water chemically bound or combined in the mineral. Whatever the state of combination of the water, it is known that if combined water be absent from the mineral in its natural state, or if the water originally present be completely removed by slow preliminary heating, the desired expansion does not occur at the softening temperature. It is necessary, therefore, to select a raw mineral containing a proportion of combined water, i.e., sufficient to produce expansion. The permissible range of combined water content is usually but not necessarily from 0.5% to 6.0% by weight, though better overall results will usually be had when the water content is within the range from 1.5% to 3.5%. The product of this artificial expansion consists mainly of aggregations of fully or partially sealed cells or voids having thin, glassy walls.

In a broad embodiment the invention comprises subjecting comminuted perlitic minerals to thermal treatment, more particularly at a temperature at which the mineral becomes plastic, thereby resulting in the evolution or volume increase of water vapor. The resulting expansion of the plastic particles causes a many-fold increase in the size of the particles to produce a multicellular aggregate whose bulk density will depend upon the conditions of thermal expansion such as temperature, retention time in the expansion zone, particle size, water content of the mineral, etc. The step of expansion is best performed by feeding a crushed and sized raw material into a rapidly moving stream of fire gases at a temperature between 1750-2300° C., preferably in such a manner that the particles are subjected to a rapid rate of upheat and are retained in the hottest expansion zone for a fraction of a second. The expanded product, usually in suspension in the combustion or fire gases, passes into a cooling zone which may be of any convenient design. The product is collected in an apparatus such as a cyclone or series of such devices wherein the product may be segregated according to apparent bulk density, particle perlite type, and also natural pumice, in the filtration of water. More specifically, it has been proposed to prepare a —40 +80 mesh fraction of expanded perlite by crushing an aggregate of comparatively large particle size and selecting a —40 +80 mesh fraction for water filtration. As will be subsequently fully developed herein such a material is foreign to the products of the present invention both with respect to its physical properties and its efficiency as a filter aid (in the sense that the term is used herein). The mechanics of the two operations are wholly different, and correspondingly different solid agents are required.

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The products of the above operation differ from diatomaceous earth in requiring no bleaching or agglomeration with alkaline fluxes to bring about a white color or a fusion of the particles. Since the particles are composed essentially of a glassy vitreous material, they are inert, substantially unaffected by acids and are attacked only by strong alkaline solutions. They may be used in the clarification of edible liquids such as sugar solutions, fats, wines, etc. without risk of imparting foreign color, odor or taste to the filtered liquids.

In producing novel perlitic filter aids attention should be particularly paid to the following features, some of which we have found to be highly desirable and some which are absolutely essential:

(1) The expanded cellular (vesicular) perlite aggregate should not have an apparent bulk density above about 15 lbs. per cu. ft. This is measured by permitting the expanded mineral to fall freely into a graduated cylinder and measuring the weight and loose settled volume of a given amount of the product.

(2) The crushed, ground or fragmented material should be substantially free from cellular or expanded material which will float in water. In preparing filter aids comparable to the highest quality diatomaceous earth filter aids of the type used in sugar filtration and similar filtration problems, the percent float in our perlitic filter aids should be not more than about 5% by volume. In some instances the percentage of float material which may be tolerated will be as high as 10%, but we regard this as a maximum and further amounts of such contaminant should be avoided.

(3) To produce a "filter aid" in the sense that the term is used herein, and in the appended claims, our novel perlitic filter aids should have a particle size so that substantially all of the material will be less than 149 mu. The maximum values to be placed on the minimum particle size will vary with each particular filtration problem. In many cases the filter aid should contain only a small proportion of material which will be less than 2 mu., while in other cases we have found that up to 20% of—3 mu. material is desirable, and in a few instances as much as 40% of —3 mu. material may be tolerated.

(4) Our perlite filter aid products should have a cake density of less than 30 lbs. per cu. ft., preferably between 10 and 20 pounds. The cake density of a filter aid is measured by suspending the filter aid in water and passing the suspension through a screen or cloth filter which will retain the filter aid. The "cake density" (lbs. per cu. ft.) is calculated from the volume and dry weight of the resulting filter cake.

It should be understood that in some instances minor departures from some of these specifications will be in order and are within the scope of the invention.

In many instances our perlite filter aids can be prepared merely by comminuting or fragmenting an expanded perlitic mineral to meet previously prescribed specifications particularly regarding particle size and particle size distribution and usually cake density. In many instances it will be necessary (in order to meet specific and rather tight specifications) to subject the comminuted material to classification which may be done in either an aqueous or air medium.

In a specific embodiment of the invention, comminuted perlite, preferably —20 mesh, is expanded at a temperature of about 1700° C. by dropping the perlite directly into a flame and conveying the expanded product out of the hottest zone in the furnace in a fraction of a second. The product is air conveyed through a pipe into which secondary air is introduced for purposes of cooling, and the air stream containing expanded particles is fed directly into a fan blower operating at high speeds. The blower is operated in such a manner that the milled product will contain less than 5% of matter which will float in water. The milled product is collected in a cyclone whose operation is regulated to collect a product so that eventually all of this will be less than 149 mu. In order to produce a highly useful general purpose filter aid, the cyclone is operated in a manner so that most of the +40 mu. material will be discarded or recycled to the milling operation. For example, a highly useful filter aid having the following particle size distribution may be produced by this means:

Above 40 microns	5%
40 to 20 microns	20%
20 to 10 microns	30%
10 to 6 microns	20%
6 to 2 microns	20%
Below 2 microns	5%

The above figures were obtained by ASTM Method No. D422-39.

In a further embodiment of the invention an expanded perlitic mineral was brushed through wire mesh screens of 100, 200 and 325 mesh per linear inch (149, 75 and 45 mu. respectively). This operation broke down the cellular structure of the perlite aggregate and the resulting powders subsided when stirred into water. The flow rates and clarifying powers were then determined on the three samples and compared to a standard of "Dicalite Speedplus" diatomaceous earth filter aid, which is a high grade free flowing material extensively used in the clarification of raw sugar solutions. The following sets forth the results of these tests, the flow rate and clarifying power of the diatomaceous earth filter aid being assigned a value of 100 the figures for the samples of perlite filter aids being comparative.

	Flow Rate	Clarifying Power
Speedplus (diatomaceous earth)	100	100
Perlite, through 100 mesh	236	88
Perlite, through 200 mesh	86	90
Perlite, through 325 mesh	83	91

The above figures show that the two essential properties (flow rate and clarifying power) of the perlite product approach very closely those of a high grade diatomaceous earth filter aid.

In a further embodiment of the invention volcanic ash, which according to some authorities is a naturally comminuted finely divided mineral of the perlite type, was expanded in a furnace at a temperature of about 950°C. by dropping the mineral directly into the flame from the burner. The resulting product prior to comminution to break down the cellular structure had an apparent bulk density of about 2.3 lbs. per cu. ft. and consisted of 85% float material. In its expanded form this product, or a

—100 mesh fraction thereof, is essentially useless as a filter aid but is suitable for the percolation-filtration of water. This product was comminuted in a Raymond mill untill the product was essentially free from float material and devoid of cellular structure. The material was air classified, the resulting product having the following particle size distribution:

Less than 3 mu.	12% by weight
3-10 mu.	68%
10-20 mu.	16%
Greater than 20 mu.	3%

This product had a cake density of 11.2 lbs. and, when compared to a diatomaceous earth filter aid of approximately the same clarity when applied to the filtration of a standard raw sugar, had a clarifying power of 85 and a flow rate of 168. The filter aid dosage employed was 0.2% by weight based on the sugar content of the solution.

In a further embodiment of the invention the cyclone fines from a perlite expansion operation designed to produce a major proportion of plaster or concrete aggregate (7-15 lbs. per cu. ft. apparent bulk density) was selected. In most commercial operations of this type the cyclone fines will have an apparent bulk density of 4-6 lbs. and the majority of such a product will pass a 100 mesh screen. While such a material finds some utility in the percolation-filtration of water, and is often equivalent in this respect to a sand filter, it has no utility in the clarification of liquors containing colloidal or mucilaginous substance. This cyclone product was milled to produce a product the majority of which has a particle size less than 149 mu. When classified so that the majority of the particles will fall between 2 mu and 40 mu., and particularly when the 3-10 mu. fraction is in excess of 60% by weight, this perlite filter aid is comparable to the best quality diatomaceous earth filter aid.

In a further embodiment of the invention a comminuted perlite mineral (—100 mesh) was expanded in a furnace at a temperature of 900-1300°C., the bulk density of the resulting cellular product depending upon the furnace temperature as follows:

Bulk Density Lbs./Cu. Ft.	Maximum Furnace Temperature
3	950°C.
2	1050°C.
1.5	1250°C.

Milling of the 2 lb. material in a Raymond mill produced a product substantially free from float material and all of which passed a 150 mesh screen. The cake density was approximately 17 lbs. per cu. ft. and the flow rate and clarifying power when compared to a diatomaceous earth filter aid of comparable quality averaged 95 and 103% respectively.

In a further embodiment of the invention a comminuted or fragmented perlite aggregate of the type described above was subjected to air classification to produce a majority product having a medium flow rate (as defined by and within the specifications of Table II). The baghouse fraction of this material was found to have the following particle size distribution:

Less than 3 mu.	35% by weight
3-10 mu.	63%
10-20 mu.	2%

When compared to a diatomaceous earth filter aid of comparable quality this product has a flow rate and clarifying power of 108 and 105% respectively.

In a further embodiment of the invention the cyclone fines from a perlite expansion operation designed to produce a major portion of a plaster aggregate was collected. As mentioned above, this material usually averages about 4-6 lbs. bulk density. This material was subjected directly to air classification to produce a product having the following particle size distribution:

Less than 3 mu.	12% by weight
Less than 6 mu.	48%
Less than 10 mu.	84%
Less than 20 mu.	95%

and which was substantially free from float material. When compared to a high quality diatomaceous earth filter aid in a standard sugar filtration the comparative flow rate and clarifying powers of the product were 184 and 110 respectively.

A series of filter aids as above described may consist of any desired number of individuals, graduated as to flow rate, and in the manufacture of diatomaceous earth filter aids it is common to divide the series into five or even more grades. We have found, however, that in the use of the perlitic minerals as starting material, almost all actually occurring situations may be met by a series consisting of three grades, to-wit: a low flow rate product, having a flow rate less than 150 ml.; a medium flow rate product, having a flow rate between 150 and 300 ml., and a high flow rate product, having a flow rate greater than 300 ml.

Unless otherwise specified the abbreviation "ml." designates the quantity of filtrate, in millilitres, collected in the first 21 minutes of a standard filtration cycle employing, as the liquid to be filtered, a 60° Brix aqueous solution of raw sugar (at 80°C.). To this liquid is added from 0.1 to 0.4% of filter aid as indicated just prior to Table 4 and the resulting liquor is passed through a ¾" diameter filter for a 21 minute period, the pressure on the system being uniformly raised from 10 to 40 PSI at 3 minute intervals (10 lbs. each) during the first 9 minutes of the test. This manner of expressing the flow rate differs from that in which the flow in ml. of the sample being tested is compared with that produced by the addition of an equal quantity of some particular filter aid taken as a standard. Its advantage for the present purpose lies in the fact that it permits widely different flow rates to be compared directly and shown graphically on a common scale.

Examples of three products typical of the present invention are described in the tables following, in which Tables 1, 2 and 3 give the particle size distribution both serially and cumulatively, of high, medium and low flow rate products, respectively. Tables 4, 5 and 6 compare the flow rates of these products with diatomaceous earth filter aids of comparable flow rate when used in quantities ranging from 0.1% to 0.4% by weight based on the sugar content of the solution being filtered; Tables 7, 8 and 9 compare the clarifying values of these filter aids.

TABLE 1

HIGH FLOW RATE PRODUCT

Particle Size Distribution—Serial			
Specimen No.	1	2	3
Below 3 mu.	3	6	0
3 to 6 mu.	14	10	1
6 to 10 mu.	30	26	15
10 to 20 mu.	42	30	52
20 to 40 mu.	8	15	21
Above 40 mu.	3	13	11
Particle Size Distribution—Cumulative			
Below 3 mu.	3	6	0
" 6 mu.	17	16	1
" 10 mu.	47	42	16
" 20 mu.	90	72	68
" 40 mu.	97	87	89
Above 40 mu.	3	13	11

TABLE 2

MEDIUM FLOW RATE PRODUCT

Particle Size Distribution—Serial

Specimen No.	4	6	7	8
Below 3 mu.	12	6	6	6
3 to 6 mu.	36	24	14	17
6 to 10 mu.	36	45	40	36
10 to 20 mu.	11	22	30	34
20 to 40 mu.	1	3	9	7
Above 40 mu.	4	0	1	0

Particle Size Distribution—Cumulative

Below 3 mu.	12	6	6	6	6
" 6 mu.	48	30	20	17	17
" 10 mu.	84	75	60	64	64
" 20 mu.	95	97	90	94	94
" 40 mu.	96	100	99	99	99
Above 40 mu.	4	0	1	1	1

TABLE 3

LOW FLOW RATE PRODUCT

Particle Size Distribution—Serial

Specimen No.	11	12	13
Below 3 mu.	22	34	28
3 to 6 mu.	67	50	52
6 to 10 mu.	8	14	18
10 to 20 mu.	2	2	2
20 to 40 mu.	1	0	0
Above 40 mu.	0	0	0

Particle Size Distribution—Cumulative

Below 3 mu.	22	34	28
" 6 mu.	89	84	80
" 10 mu.	97	98	98
" 20 mu.	99	100	100
" 40 mu.	100	0	0
Above 40 mu.	0	0	0

The properties of these products which measure their value and adaptability for use as filter aids are set forth in the following Tables 4 to 9 inclusive.

In Tables 4, 5 and 6 the flow rates in millilitres, as above described, are listed for dosages of 0.1%, 0.2%, 0.3% and 0.4% by weight, based upon the solids content of the solution clarified. In Tables 7, 8 and 9 the clarifying values of the products are compared, in each table, with the clarifying value of a commercial diatomaceous earth filter aid of the best quality and of approximately the same flow rate.

TABLE 4

HIGH FLOW RATE PRODUCT

Flow Rates in Millilitres

Specimen No.	1	2	3	A[1]	B[1]
0.1% dosage	385	292	340	207	237
0.2% "	450	408	417	372	374
0.3% "	433	415	435	435	443
0.4% "	441	431	447	486	489

---

[1] A and B are diatomaceous earth filter aids.

TABLE 5

MEDIUM FLOW RATE PRODUCT

Flow Rates in Millilitres

Specimen No.	4	6	7	8	A	B
0.1% dosage	184	173	138	161	79	99
0.2% "	212	217	185	204	169	172
0.3% "	219	232	196	221	220	207
0.4% "	221	229	199	219	241	231

TABLE 6

LOW FLOW RATE PRODUCT

Flow Rates in Millilitres

Specimen No.	10	11	12	A
0.1% dosage	33	57	16	20
0.2% "	66	70	24	66
0.3% "	85	58	30	71
0.4% "	78	40	20	103

TABLE 7

HIGH FLOW RATE PRODUCT

Clarifying Value vs. Diatomaceous Filteraid

Specimen No.	1	2	3	A	B
0.1% dosage	1.13	1.20	1.25	1.37	1.00
0.2% "	1.08	1.17	1.39	1.25	1.00
0.3% "	0.93	1.15	1.14	0.94	1.00
0.4% "	1.05	1.06	0.97	0.89	1.00

TABLE 8

MEDIUM FLOW RATE PRODUCT

Clarifying Value vs. Diatomaceous Filteraid

Specimen No.	4	6	7	8	B
0.1% dosage	1.20	0.98	1.15	1.20	1.00
0.2% "	1.11	1.00	1.05	1.05	1.00
0.3% "	1.10	0.98	1.01	0.90	1.00
0.4% "	0.94	0.81	0.95	0.74	1.00

TABLE 9

LOW FLOW RATE PRODUCT

Clarifying Value vs. Diatomaceous Filteraid

Specimen No.	10	11	12	A
0.1% dosage	0.93	0.90	1.20	1.00
0.2% "	0.97	0.93	1.25	1.00
0.3% "	0.96	0.93	1.20	1.00
0.4% "	0.96	0.93	1.16	1.00

These results are shown graphically in the attached figures, which are numbered to correspond with the tables. In the three figures 1, 2 and 3, representing particle size distribution, and in the three figures 4, 5 and 6 representing flow rate, the references are to common standards and as the charts are drawn to the same scales they may be compared directly by noting the relative positions of the groups of curves on the charts. The three figures 7, 8 and 9, representing relative clarity, refer to different standards and cannot be compared directly.

Referring first to Fig. 1, the high flow rate product is characterized by a large preponderance of particles in the 10-20 and 20-40 micron ranges and a very small proportion of particles smaller than 3 mu. These two characteristics are essential to a high flow rate.

The heavy lines lying outside the group of curves indicate the limits of proportion for a perlitic filter aid of this grade, the experimental results indicating the following cumulative specification:

Smaller than 3 microns ... 0% to 8%
Smaller than 6 microns ... 0% to 20%
Smaller than 10 microns ... 12% to 50%
Smaller than 20 microns ... 60% to 90%
Smaller than 40 microns ... 80% to 100%
Larger than 40 microns ... 20% to 0%

or in more general terms, a high flow rate perlitic filter aid may desirably have its constituent particles distributed as follows:

Smaller than 3 microns . . . Not more than 8%
Larger than 10 microns . . . Not less than 50%
Larger than 40 microns . . . Not more than 20%

these percentages being by weight and particle sizes being determined by sedimentation.

Referring to Fig. 4, illustrating the relative flow rates of these products, it will be seen that all of the flow rates are high, of the general order of 400 ml. at 0.2% dosage, and that they all lie above the flow rates of the comparable diatomaceous filter aids at 0.1% and 0.2% but fall below them at 0.4%. The same observation holds as regards relative clarifying power, as illustrated in Fig. 7. In this figure the clarifying power of the diatomaceous filter aid is taken at 1.0 at each of the four dosages.

This behavior appears to be typical of the high flow rate filter aids prepared from artificially expanded perlite minerals, and indicates that this grade of perlitic product will find its greatest utility in instances in which a relatively small proportion of filter aid is required to produce the requisite degree of clarification.

Referring to Fig. 2, it will be seen that the concentration of particle size is in the medial part of the diagram, having moved far to the left from the position shown in Fig. 1. As would be expected, the flow rates are much reduced, being in the region of 200 ml. at 0.2% dosage, or about half that of the freer flowing grade.

As in Fig. 1, the heavy lines bounding the group of curves indicate the most desirable limits of particle size range, the experimental results indicating the following cumulative specification:

Smaller than 3 microns ... 5% to 15%
Smaller than 6 microns ... 15% to 50%
Smaller than 10 microns ... 55% to 85%
Smaller than 20 microns ... 85% to 100%
Smaller than 40 microns ... 95% to 100%
Larger than 40 microns ... 5% to 0%

or in more general terms, a medium flow rate perlitic filter aid may well have its constituent particles distributed as follows:

Smaller than 3 microns ... Not more than 15%
Larger than 10 microns ... Not more than 45%
Larger than 40 microns ... Not more than 5%

these percentages being by weight and particle sizes determined by sedimentation.

The comparison between perlitic and diatomaceous filter aids as regards flow rate and clarity are evident in Figs. 5 and 8, but the divergences are much less marked than in the high flow rate product. As a whole, these medium flow products are of excellent quality, being slightly superior to the diatomaceous products at the lower dosages.

Referring to Fig. 3, the low flow rate product is seen to consist almost entirely of particles smaller than 10 mu., the presence of any large proportion of larger particles tending to raise the flow rate and decrease the clarifying value. The experimental results indicate the following cumulative specification:

Smaller than 3 microns...	15% to 40%
Smaller than 6 microns...	50% to 90%
Smaller than 10 microns...	75% to 100%
Smaller than 20 microns...	90% to 100%

or in more general terms, a low flow rate perlitic filter aid may well have its constituent particles distributed as follows:

Smaller than 3 microns...	Not more than 40%
Larger than 10 microns...	Not more than 25%

these percentages being by weight and the particle sizes determined by sedimentation.

Comparing Figs. 6 and 9 with Figs. 4-5 and 7-8 respectively, it will be seen that the before-mentioned characteristic divergences between the curves for flow rate and clarifying value of perlitic and diatomaceous filter aids have substantially disappeared, and these low flow rate products may be considered first quality materials for use in situations in which high clarifying value is required.

While the three products described have different particle size distribution, fitting them for use in situations requiring different relations of flow rate to clarifying power, they have the common characteristic of close restriction of the proportions of end sizes which distinguishes them from any perlitic product heretofore known.

Thus, if the three specifications are compared it will be seen that the preferred maximum permissible proportion of particles larger than 40 mu. is 20% by weight in the coarsest and freest flowing member of the series, while the preferred maximum permissible proportion of particles smaller than 3 mu. is 40% by weight in the finest and tightest member.

Particles larger than 40 mu. merely distend the filter cake without performing any useful function, thus reducing the throughput capacity per press cycle and also reducing the unit clarifying value of the product. Particles smaller than 3 mu. progressively reduce the flow rate as the proportion increases.

For these reasons, a perlitic filter aid meeting the specification

Smaller than 3 microns . . . Not more than 40%
Larger than 40 microns . . . Not more than 20%

will be a particularly useful and valuable filter aid in one or another type of clarification, regardless of the particle size distribution of the remaining 50% of the product. This distribution, however, determines the specific use to which the filter aid is best adapted.

As already pointed out, the products herein are useful only in processes in which the filter aid is first dispersed in the liquid to be clarified and is thereafter filtered out or when used as a precoat in certain filtration operations, as distinguished from the so-called percolation systems, in which a granular mineral is formed into a bed or pack through which the turbid liquid is filtered, by reason of their very low throughput in thick layers.

On the other hand, run-of-kiln expanded perlite, crushed pumice, or expanded perlite from which particles smaller than 80 mesh (about 175 microns) have been removed, are well adapted to use in percolating systems being comparable to sand filters, but are useless in premixing processes because of their low clarifying value. Thus while each of the two types of product might loosely be termed a filter aid, the products are easily differentiated by their physical characteristics, in manner of utilization and in the types of turbid liquid which they clarify. This is more clearly brought out in the following tests wherein perlite filter aids of the type presently under consideration are compared with coarse expanded perlite aggregates, particularly —40+80 mesh products. In the following table the first two products correspond to Specimen Nos. 4 and 6 previously referred to in the tables. The —40+80 mesh perlite (I) is a perlitic product prepared by screening a plaster aggregate of expanded, cellular perlite through a 40 mesh U. S. series screen and discarding the fraction retained on the screen, and thereafter passing the retained fraction over an 80 mesh U. S. series screen and discarding the material passing through this screen. The final product which was tested thus had a particle size range of —40 to +80 mesh (420 - 177 mu.). The —40+80 mesh (II) sample is a perlitic product obtained by passing a coarse (+12 mesh) expanded, cellular perlite aggregate through a Raymond mill and screening the milled product in the same manner as the (I) sample, the II sample thus having a particle size range of —40 to +80 mesh (420 - 177 mu.). The sand sample is a crystalline silica sand, the majority falling within a —40 to +80 mesh fraction. The volcanic ash sample is a product obtained by thermally expanding volcanic ash in a manner previously described herein and screening the lightweight product through a 100 mesh U. S. series screen and retaining the material passing through the screen for test purposes.

Portions of these samples were tested for flow rate and clarity of filtrate by test methods standardized for the evaluation of diatomaceous earth filter aids, the various samples being added in doses of 0.4% by weight based on the sugar content of a 60° Brix raw sugar solution. A thin layer of diatomaceous earth filter aid was employed as a precoat on the filter cloth. In the filtration cycles employed, a uniform pressure of 40 lbs. per sq. in. gauge was maintained throughout the standard 21 minutes filtering cycle. Clarifying power is reported as "relative clarity" as compared with the standard diatomaceous earth filter aid of commerce known as "Dicalite Speedplus".

TABLE 10

	Relative Flow Rate	Relative Clarity	% Float
Specimen No. 4	75.0%	111%	—
Specimen No. 6	91.5	90	—
—40 + 80 mesh (I)	4.3	None	86
—40 + 80 mesh (II)	3.3	None	15
Sand	4.7	None	—
—100 mesh volcanic ash	2.4	None	80
Diatomaceous earth	100	100	—

Comparison of the flow rate and clarity figures for Specimens 4 and 6 with those for the —40+80 mesh (I) and (II) shows that the perlite filter aids are products which approach very closely high quality diatomaceous earth filter aids in respect to both flow rate and clarifying power. The —40+80 mesh perlite products have substantially no clarifying power and in this respect are no better than an ordinary sand filter.

The above data also strongly brings out the fact that merely decreasing the particle size, i.e., selecting a perlite aggregate of —100 mesh, instead of —40+80 mesh, is inadequate as a measure or standard in the preparation of high quality filter aids.

The above data further brings out the fact that the —40+80 mesh perlite aggregate products and the sand filter not only have substantially no clarifying power but permit colloidal or mucilaginous materials to pass through the filter and rapidly accumulate on the filter cloth or screen. This results in a rapid blinding off of the filter with attendant cessation of filtration.

The inadequacy of both —40+80 mesh samples of perlite aggregate are further brought out in a similar series of tests in which 0.2% by weight of a finely divided decolorizing carbon was added to a 60° Brix raw sugar solution. This is a type of liquid-containing suspended solids which is often encountered in sugar refining operations. In the tests tabulated below the filter aid dosage was 0.6% by weight by the water content of the solution:

	Relative Flow Rate	Relative Clarity
Specimen No. 4	132	111
Specimen No. II	2	None
Diatomaceous Filter Aid	100	100

As previously mentioned, microscopic examination of the filter aids of the present invention indicates the perlite filter aids to have a plate-like, angular and irregular structure. During the filtration operation these particles interlace to form a felt-like filter cake having a great number of very minute and tortuous channels through which liquid may flow. The filter cakes of such agents retain even fine suspensions throughout the mass without losing their liquid permeability. The flow rate decreases only in proportion to increase in thickness of the filter cake, and the colloidal matter suspended in the solution never reaches the surface of the membrane supporting the filter cake other than during the brief period when the filter cake is formed. Microscopic examinations of the —40+80 mesh products I and II shows them to be globular in form, the No. I product consisting mainly of particles with sealed voids, whereas the No. II product, while containing only 15% float material, nevertheless consists of clusters of partially sealed voids which are totally devoid of the flat plate-like and irregular structure which characterizes the perlitic filter aids of this invention. For this reason the coarse perlite aggregates are apparently incapable of retaining fine colloidal matter, as they are incapable of felting and have relatively wider and direct paths through which the liquid flows. This permits the suspended matter to pass freely through the filter cake, to be deposited on the filter cloth or screen, thereby choking the pores and arresting filtration.

We also wish to emphasize that mere selection of any inert material by prescribing certain particle size and particle size distribution limitations which characterize high grade diatomaceous earth filter aids is not sufficient to prepare other filter aids. For example, finely ground silica sands (—325 mesh) were air classified to prepare a product having a particle size distribution similar to that of high grade diatomaceous earth filter aids, and these were tested in a standard sugar filtration cycle according to the techniques used in previous examples. Concentration of the filter aid was 0.3% by weight of the sugar content of the solution. The particle size distribution and the flow rate and clarity readings are as follows:

TABLE 11

			Part. Size Distribution (Wt. %) in. Microns			
Agent	FR	C1	-3	3-10	10-20	20-40
D.E. No. I	105	89	10	60	13	11
D.E. No. II	83	112	3.0	89	8	—
D.E. No. III	222	78	1.0	33	53	13
Classified Sand I	8	25	1.0	79	20	—
Classified Sand II	14	29	1.0	32	54	13
None	29	7				

The filtrations involving the classified sand samples were extremely poor for the reason that the colloidal matter in the sugar solution rapidly accumulated in the filter press cake and blinded off the cake thereby stopping substantially completely the passage of further liquid. The flow rates were extremely slow even at the start of the filtration cycle. It logically follows that silica sand when ground and classified to a particle size distribution approximating that of high quality diatomaceous earth filter aid is nevertheless worthless as a filter aid. It was also observed that the classified sand samples afford a poorer flow rate than when merely a filter cloth is used in the filtration without addition of filtration agents. This further brings out the necessity of proper selection of raw material for the manufacture of high quality filter aids, this material being, in the present instance, of perlitic nature.

Paper No. 8 Jul. 8, 1953

Examiner's Answer

This is an appeal from a rejection of claims 1-10, 12-14, and 16-21. No claims are allowable. Applicants appealed before a final action on the case.

A correct copy of the appealed claims appear on pages 1-5 of the applicants brief. However, claims 1 and 17 are incorrect and are herewith correctly copied.

Claim 1: A filter aid consisting essentially of the comminution product of an artificially expanded multi-cellular perlitic mineral, said product containing not more than 40% by weight of particles smaller than 3 microns and not more than 20% by weight of particles larger than 40 microns, said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

Claim 17: A process according to Claim 21 wherein the bulk density of the expanded, cellular perlite is between about one and about six lbs. per cu. ft. and wherein the filter aid product contains not more than 40% by weight of particles smaller than 3 microns and not more than 20% by weight of particles larger than 40 microns.

A correct listing of the references relied on appears on page 5 of applicant's brief.

The invention is adequately described in applicant's brief.

Rejection

All the claims are rejected as unpatentable over the C.A. article, singly, or in view of the C.M. article and Thatcher. The C.A. article discloses expanding perlite and then crushing it to 40-80 mesh. Applicant's crush theirs finer but this is not a patentable variation of the reference process. The steps are the same—expanding, then crushing. The process claims are clearly unpatentable over the C.A. article since they differ only in reciting a finer grinding, a mere difference of degree. The product also differs only in mesh size from the C.A. article and it is believed that one would expect from Thatcher that a finer product would be a better filter aid. The C.A. article does not use the expression "filter aid" per se, but the C.M. article does; hence one would expect to use the product of the C.A. article as a filter aid and to modify its size according to Thatcher. The C. and M. article teaches using expanded perlite as a filter aid, and to crush it finer, than the 40-80 mesh of the C.A. article, is suggested by Thatcher whose filter aid has a particle size range similar to that claimed here. One would naturally assume that the particle size range taught by Thatcher would be applicable to other filter aids such as perlite. It is also natural to suppose that it would be necessary that the material not float but it is believed unnecessary to crush it to insure this. Fine particles of expanded perlite will subside in water even when uncrushed. The C. and M. article probably had reference to those.

It is applicants argument that Thatcher's teachings are not necessarily applicable to perlite, but the Examiner believes otherwise in view of the fact that both Thatcher and the C.M. article show filter-aids and the teachings of one would therefore be suggested to the other.

All the claims are further rejected on the ground of res judicata. The parent case, Serial No. 688,430, adjudicated the same subject matter before the Board of Appeals who held that, "the choosing of an effective size range, which we consider to be produced by the degree of grinding, in view of the material to be filtered would be within the expected skill of one working in the filtering field .... With respect to the process claims the limitation to crushing to completely destroy the cellular structure and designation of particle size recovered are differences in degree and we think that the same applies to the product claims".

Examiner, Div. 64

MTR:ln

Carl F. Peters
8210 Austin Ave.
Morton Grove, Illinois

Paper No. 13 Mar. 31, 1954

Decision of Board

This is an appeal from the action of the Examiner finally rejecting claims 1 through 10, 12, 13, 14 and 16 through 21. No claim stands allowed.

Claims 1 and 20 are representative.

> 1. A filter aid consisting essentially of the comminution product of an artificially expanded, multicellular perlitic mineral, said product containing not more than 40% by weight of particles smaller than 3 microns and not more than 20% by weight of particles larger than 40 microns, said product having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

20. A process for producing a filteraid which comprises expanding a perlitic mineral to form a low bulk density, multi-cellular aggregate, comminuting said aggregate to produce a fragmental product whose particles are substantially less than 149 microns in size and which contains not more than about 40% by weight of particles smaller than three microns in size, the milled product further having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

The references relied upon are:

Thatcher	Re. 19,166	May 15, 1934

Compressed Air Magazine, Vol. 47, p. 6694 (1942)
Chem. and Metallurgical Engineering, Vol. 52, pp. 140 and 142 (July 1945).

In the above listing we have corrected the page citation from the Compressed Air Magazine to correspond with that in the parent application.

Appellant describes his alleged invention in his brief, page 5, in the following summation:

> "The invention resides in the discovery by applicants that high-quality filteraids competitive with commercial grade diatomaceous earth filteraids can be made by artificially heat expanding a volcanic glass of the perlite type thereby producing a product of low apparent density; and thereafter substantially destroying the cellular walls of the product to produce a material consisting essentially of fragments or broken down cell walls. This final product is substantially free from cellular material (i.e. material which will float in water). The fragmentation may be accomplished by milling or other means and the product should be essentially minus 149 microns in size; the majority of the particles will be smaller than 40 microns. Furthermore, the material will not contain more than 40% of minus 3 micron material."

Claim 1 is representative of the broadest product claimed while claim 20 is typical of the process.

All the claims stand rejected as unpatentable over an article from the Compressed Air Magazine, which discloses heating perlite to expand it followed by crushing to 40 to 80 mesh to produce a material suitable for filtering water, singly or in view of an article from Chemical and Metallurgical Engineering and Thatcher. The Chemical and Metallurgical Engineering article also deals with expanded perlite and refers to a possible use thereof as filter aid. The Thatcher patent is to a finely divided diatomaceous filter aid containing a certain maximum percent of a large and a certain maximum percent of small particles. The Thatcher invention is based on his discovery that the particle size distribution in a filter aid has an important bearing on the effectiveness of such material. Appellants admit that the particle size distributions in the Thatcher material is similar to that in their perlitic filter aid.

The Examiner's position is that the process claims differ from the Compressed Air Magazine article only in reciting finer grinding, which is a mere difference of degree. Similarly it is held the product differs only in degree and that in any event one would expect from Thatcher that a finer product would be a better filter aid. The Chemical and Metallurgical Engineering article is relied on to supply the concept of using expanded perlite as filter aid. The Examiner concludes that it is apparent that one could use the product of the basic reference as a filter aid and to modify the size according to Thatcher for best results.

Appellants consider the Examiner's holding to be in error because there is no concept in any of the references of completely destroying the sealed or partially sealed voids of expanded perlite. This is said to be necessary to produce a suitable filter aid. Reference has been made to Table 10 on page 27 of the specification comparing the filter aid characteristics of appellants' material with expanded perlite ground to 40 to 80 mesh, with sand; with 100 mesh volcanic ash, and with diatomaceous earth as a standard. The 40 to 80 mesh material, said to correspond to the material of the Compressed Air Magazine, had a flow rate similar to sand but no significant clarifying power and, in addition, in the best example had 15% of float. We have referred to the photomicrographs and affidavits of record in the parent application in connection with this comparison. It is appellants' belief that in view of the ineffectiveness of the material of 40 to 80 mesh size that the difference involved is one of kind rather than degree. The Thatcher teaching of particle sizes in diatomaceous filter aids is contended to be purely fortuitous and not applicable to a different material, such as perlite.

Upon careful consideration of the record in this case and appellants' arguments, as well as the showings made in the parent case, we are not persuaded of any error in the rejection. Clearly no new procedure is involved here because the Compressed Air Magazine discloses both the expanding and the comminuting step. The degree of grinding is, of course, merely a matter of choice. No new procedure is involved merely because of a difference in the size to which the particles are ground. While appellants' final product appears finer in size than the 40 to 80 mesh of the basic reference, we do not conceive it to be inventive to grind to the sizes specified in view of the teachings of Thatcher relative to the advantages of having a filter aid in the general particle size range now claimed. In our opinion this teaching would appear to be applicable to materials other than diatomaceous earth. While it is true that the Compressed Air Magazine article only mentions use of the material for filtering water, the suggestion that it could be used as filter aid is supplied by the Chemical and Metallurgical Engineering article. We therefore see nothing inventive in appellants designation of this material as filter aid even assuming this is of some significance in the claims.

The claims stand further rejected on the ground of *res judicata* based on the adverse decision of this Board in appellants' parent application, Serial No. 688,430 decided

May 14, 1952, Appeal No. 27,685. The claims in that case required the particles to be less than 149 microns in size. The present claims are more limited as to the particle size and for that reason appellants urge that this rejection is not applicable. In our opinion the considerations which determined appellants' parent case are equally applicable here. It is obvious that in grinding particles to less than 149 microns in size there will inevitably be large percentages of finer material produced within ranges now indicated. It appears to us that mere recital of these additional characteristics of the product does not avoid a rejection on the ground of *res judicata.* In order to escape this ground of rejection the claims in the second case must contain distinctions of patentable significance over those previously considered. No such distinctions have been shown to exist here. *In re* Prutton, 674, O.G. 550; 97 USPQ 447; 40 C.C.P.A. (Pats.); *In re* Ellis, 1937 C.D. 153; 24 C.C.P.A. 759; 478 O.G. 478; 86 F. (2d) 412. The rejection of the claims on the ground of *res judicata* will therefore be sustained.

The decision of the Examiner is affirmed.

Board of Appeals

E. W. GENIESSE
Examiner-in-Chief

N. A. ASP
Examiner-in-Chief

HARVEY E. KAUFFMAN
Examiner-in-Chief
(acting)

March 31, 1954

BURNS, DOANE, BENEDICT AND IRONS
8210 Austin Ave.
Morton Grove, Ill.

Plaintiff's Exhibit No. 4

Plfs. Ex. # 4

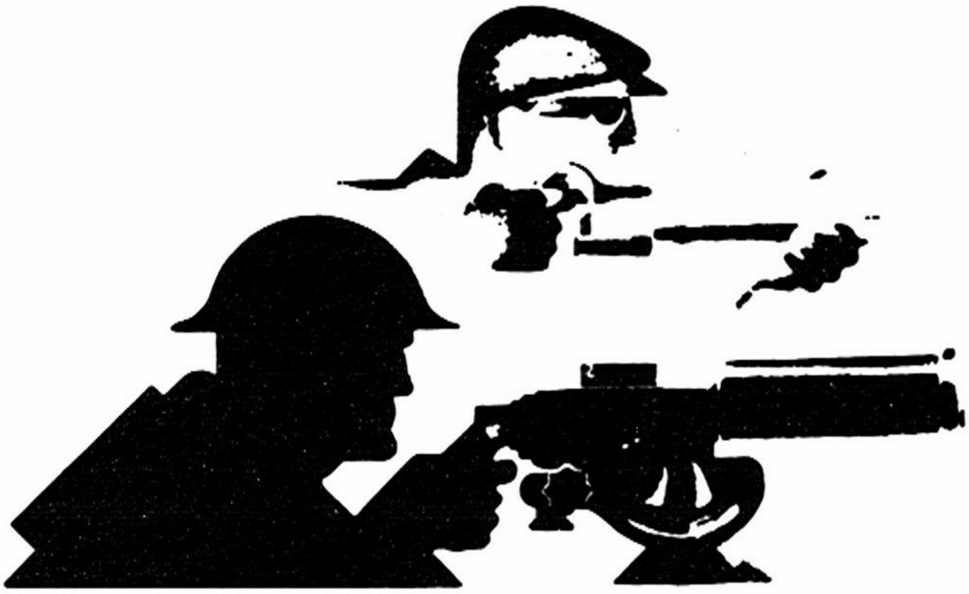
Exh. 4

New Insulating Material

SOMETHING new in insulating materials was discovered accidentally while experimenting with perlite, which is described as volcanic glass with a concentric, shelly texture and, usually, a notable percentage of water. In investigating the material with the thought of possibly using it in making enamels and other infusible products, L. Lee Boyer noticed that when perlite was exposed to heat well below its melting point it exploded like popcorn and formed a mass lighter than ground cork./ Upon examination under a microscope it was found that the product had a porous structure and that the pores were well-sealed./ Subsequent research revealed that it possessed insulating properties of value.

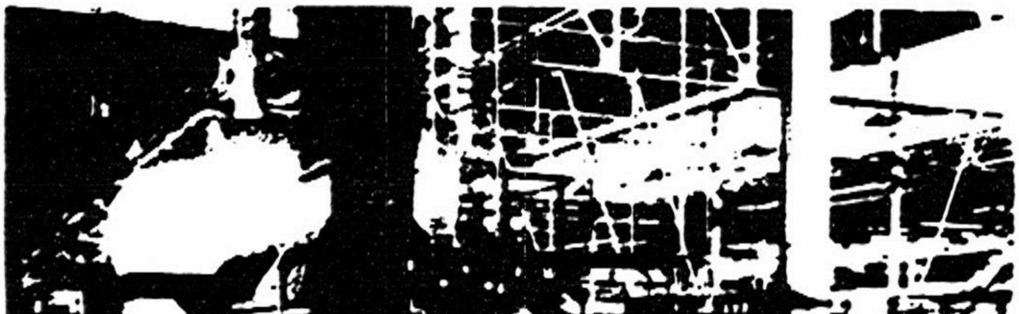
Near a large deposit of perlite in Superior, Ariz., has been erected a semicommercial plant consisting of a gas-heated cylindrical kiln lined with firebrick. Before the material is fed into one end of it it is first crushed, and in that form explodes in from 30 to 45 seconds when subjected to a temperature of 1,650 F. In less than a minute from the time it enters the kiln, the mass is discharged into a Dorr classifier where the particles of perlite, now 6½ to 7 times their original volume, float while the pieces that did not expand sink to the bottom. When dried and ready for the market the product is pure white, fluffy, and free of impurities.

According to conductivity tests, perlite has insulating properties equal to those of ground cork, rock wool, asbestos, verniculite, and similar substances. It is claimed to be an especially good fire-resistant material for construction purposes because it will not absorb water and is infusible up to a temperature of 3,000 F. When ground to 10-80 mesh it is suitable for filtering water, and, with the addition of a small percentage of sodium silicate, forms a light fire-resistant coating that adheres to wood, paper, and metal. It is estimated that the insulating material can be made at a reasonable cost, and its production on a commercial scale is soon to be started. A plant with a capacity of 75-100 tons is to be built at Superior, while another at Phoenix, is to be equipped for the manufacture of varied perlite products.



ENOUGH SAID

This poster was designed by Jean Carlu for Uncle Sam's Office for Emergency Management. Originally it bore the slogan "It Takes Both Barrels," but after the attack on Pearl Harbor by the Japanese it was changed, as shown, to express the nation's stand for all-out production and victory.



SOLDERS AUTOMATICALLY

This installation is in the plant of the Fedders Manufacturing Company and is equipped with Westinghouse Electric & Manufacturing Company electric controls. It is viewed from the discharge end and shows the conveyor with finished radiator cores, the press in which the solder is solidified, and the oven directly back of it in which the solder is brought to the flow point.

Intricate Soldering Job Done Mechanically

AN AUTOMOBILE radiator is a maze of copper tubes and fins requiring hundreds of soldered joints. Until of late it was a complicated hand job; now it can be done automatically from start to finish. The machinery—an oven and a press—have been changed over from manual to electric control and linked by a handling system—all synchronized to operate as a single unit.

The assembly of tubes, fins, and solder is put in position on the electric conveyor, which passes it through a flux spray before entering the oven. After a fixed time, long enough to bring the solder to the flow point, the conveyor starts again and carries the radiator core from the oven into the press, where it is held flat and square while a blast of air "cooks" it and solidifies the solder. When sufficiently cooled, the press opens and deposits the finished work on the conveyor ready for removal.

Plaintiff's Exhibit No. 5

ers were tested for both physical and electrical properties. A laminate made with glass cloth and an unmodified melamine-formaldehyde resin resulted in an exceedingly strong panel exhibiting outstanding electrical properties. It would not support combustion, and its arc resistance was around 180 sec. by the ASTM test method. This glass-cloth, melamine-resin laminate was acceptable to the Navy for electrical insulation purposes and is known as Navy Type GMG. Nearly all this experimental and development work was carried out in the Stamford Research Laboratories of the American Cyanamid Co., which also supplies the melamine-formaldehyde for this use.

Even before the laminates got into production, two major drawbacks had appeared to dim the picture. Under high relative humidity conditions, the laminate suffered a substantial drop in insulation resistance, and machining of the laminate proved to be difficult. Subsequently, however, it was found that the humidity necessary to cause a great drop in insulation resistance was very seldom encountered, and that under normal humidity conditions the electrical resistance was very high, around 100,000 megohms. Also, it was determined that the use of proper tooling equipment, such as carboloy or diamond-tipped cutting tools, made fabrication practical and easily within the compass of ordinary shop equipment operated by men with metal-working experience.

The armed services are now taking the entire production of glass-fabric, melamine-resin laminates for a wide variety of equipment requiring electrical insulation. These range from panel boards to slot wedges in the armatures of generators. Radio manufacturers and industrial producers in general have found uses for the material and can justify it in all cases where the workability of the apparatus hinges upon good electrical insulation. In the electrical equipment field, the new material promises longer life, wider application and higher loadings for any equipment wherein it is used.

Manufacturers and Trade Names of Navy Type GMG Laminates

Manufacturer	Trade Name
Continental Diamond Fibre Co., Newark, Del.	Dilecto
Farley & Loetscher Mfg. Co., Dubuque, Iowa	Farlite
Formica Insulation Co., Cincinnati, Ohio	Formica
General Electric Co., Pittsfield, Mass	Textolite
Mica Insulation Co., New York, N. Y	Lamicoid
Panelyte Div., St. Regis Paper Co., New York	Panelyte
Phenolite Div., Nat'l Vulcanizing Fibre Co., Wilmington, Del	Phenolite
Richardson Company, Cincinnati, Ohio	Insurok
Synthane Corp., Oaks, Pa	Synthane
Taylor Fibre Co., Norristown, Pa.	Taylor
Westinghouse Electric Corp., Pittsburgh, Pa	Micarta

TRANSPARENT TAPE

A transparent, flexible thermoplastic tape, facilitating inspection and servicing of equipment on which it is used, has been introduced by the Irvington Varnish & Insulator Co., Irvington, N. J. Useful not only as electrical insulation, Fibron Tape No. 3 also protects wiring, cables and equipment against abrasion.

The tape is heat-sealing, flame-resistant, flexible at low temperatures, and is said to resist attack by acids, alkalis, moisture, oil, grease and corrosive fumes. With proper adhesives, it may be bonded to fabric, metal, ceramics, wood and other materials. Fibron Tape has been applied successfully as gasketing materials, in the construction of automotive and aircraft lighting and ignition harnesses, and in the splicing of plastic-insulated wire and cable.

PROTECTIVE COATING

For about a year the Chemical Enamels Co., Cleveland, Ohio, has been producing a heavy duty protective coating known as Butex which was developed for the protection of surfaces where conditions are considered too severe for ordinary paints and coatings. It is particularly recommended (1) for marine exposures around ships, docks, piling, lock gates, coal bunkers, etc., where high humidity and salt combine to create severe corrosion conditions; and (2) in the industrial field to protect against corrosive gases and fluids, acid and alkali fumes, moisture and condensation.

Butex is a highly refined and specially processed bituminous (coal tar not asphalt) coating. It is an easy brushing, quick drying paint-like material and according to the manufacturer, "a far cry from the grimy, sticky, odorous product usually sold as a tar paint."

Almost any kind of clean, dry surface —metal, wood, concrete, masonry—can be brushed or sprayed with Butex, and in no case is a primer required. Black is the only color available, but the material dries to a high-gloss, enamel-like finish. It is non-oxidizing and dries only by evaporation. It is completely waterproof and is dependable to approximately 500 deg. F. The odor present when Butex is applied will contaminate food products, but this odor leaves in a few hours and will not return. One gallon covers about 500 sq. ft. on smooth metal or 400 sq. ft. on rougher surfaces.

It is recommended for use on refrigerating or air conditioning equipment, condensing coils, cooling towers, structural steel, masonry or wood structures, steel stacks, boiler fronts, and water tanks (hot or cold but not drinking).

METALLIC NAPHTHENATES

A number of new metallic naphthenates have been announced as now being available in laboratory and experimental quantities from Oronite Chemical Co., San Francisco, Calif. Descriptions of the eight new napththenates and their suggested uses are shown in the accompanying table:

Properties of Metallic Naphthenates

Naphthenate	Metal Content, %	Appearance	Suggested Uses
Barium	22	Amber amorphous solid	Sizing, waterproofing textiles
Cadmium	19	Amber solid	Flatting agent; hydration catalyst
Chromium	6.5	Amber semi-solid	Leather treating solutions; cement for linoleum and plastic resins
Mercury	29	Amber semi-solid	Fungicidal agent
Nickel	11	Green solid	Hydrogenation catalyst
Potassium	7.5	Amber semi-solid	Washing soaps containing hydrocarbons
Sodium	4.5	Amber solid	Washing soaps, disinfectants
Strontium	15	Amber amorphous solid	Rust preventive, oils and special lubricants

GALVANIZING FINISH

Greater resistance to white corrosion for galvanized products is said to be provided by application of Iridite Galvon, a recent development of Rheem Research Products, Inc., Baltimore, Md. Like its predecessor, Iridite Olive Drab for zinc and cadmium-plated parts, Iridite Galvon is applied by simple dipping at normal room temperatures. No special equipment or personnel are needed and no electric current is used in the process. The basic coating is susceptible to various dye colors.

Accelerated corrosion tests conducted by the company under U. S. Bureau of Standards salt spray specifications indicated no signs of white corrosion products on hot dipped galvanized panels after 236 hr. Iridite Galvon can be applied either to complete assemblies, parts, or to galvanized sheets previous to fabrication.

CLEANING COMPOUND

For removing grease, grime, iodine, blood stains, and numerous other forms of dirt from rugs, clothes, and walls, the Brico Corp., New York, N. Y., has developed a liquid cleaner, known as Brico. The concentrated compound is gentle to hands, fabrics, and paint, and is said to remove rubber heel marks from linoleum, and greasy shoe marks from rugs.

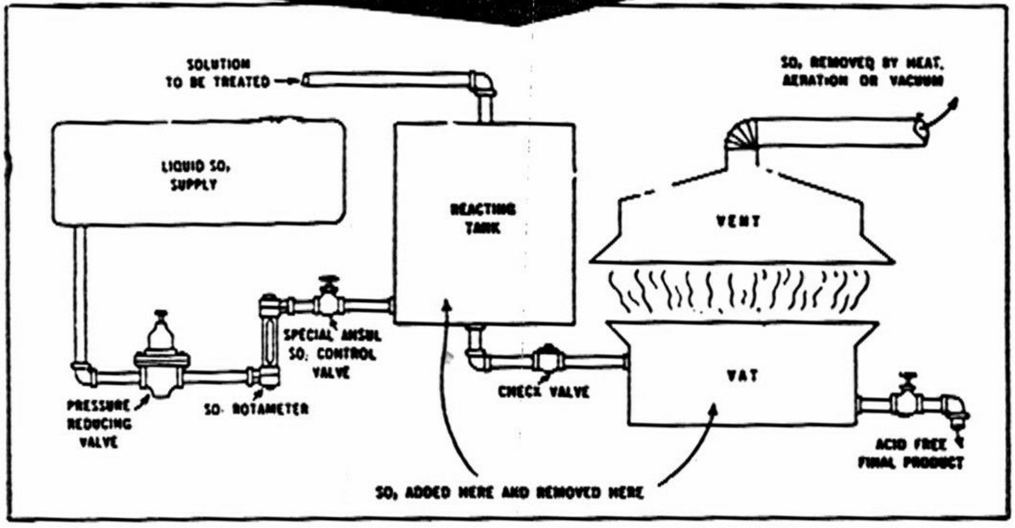
THERMAL INSULATION FROM PERLITE ROCK

Considerable interest has recently been shown by Southwest industry in a new type of insulating material produced in the region by Chemi-Cote Perlite Corp., Phoenix, Ariz. Based on perlite (sometimes spelled pearlite), a glassy, siliceous volcanic rock, the material can be produced by heating the ground rock to 1,700-2,000 deg. F. in a rotary kiln. At that temperature it melts, and simultaneously the 3-4 percent combined water is released. The result of this "explosion" is that the siliceous material almost instantly solidifies around minute air and moisture bubbles, thus sealing them to give a light material having 6-10 times the volume of the original rock and weighing anywhere from just a few pounds up to 10 lb. per cu. ft., depending upon the method and temperature of explosion.

Being cheap, a non-conductor of electricity, fireproof, immune to fungi and insects and at the same time, according to preliminary tests, a better insulating material than ground cork, asbestos or rock wool, expanded perlite is reported to have a promising future in the fields of bulk insulation for ceilings and walls of buildings, acoustical plaster, refrigeration and high-altitude aviation. Used in foundry cores in place of sand, it results in fewer bad castings. Concrete blocks consisting of 5-6 parts perlite and 1 part of portland cement weigh about 45 lb. per cu.ft. and

EVAPORATE
EXCESS ACIDITY

Use ANSUL SO_2
as an acidifying agent and remove
excess by heat, aeration or vacuum



Here is a typical SO_2 acidifying and precipitating system showing how the SO_2 is introduced and excess acidity removed.

• Ansul SO_2, a volatile acid, provides distinct advantages over mineral acids when used as an acidifying and precipitating agent. 1—Excess acidity is easily eliminated. 2—Residual acidity that might otherwise be concentrated as an impurity in the final product is minimized.

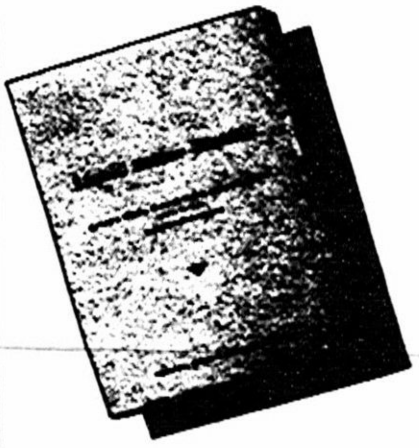
Ansul Liquid SO_2 is pure, inexpensive—easy to handle. It has unusual bleaching and preservative qualities and its use results in products of greater purity.

LIQUID Sulfur Dioxide BY ANSUL

PHYSICAL PROPERTIES

Chemical formula	SO_2
Molecular weight	64.06
Color (gas and liquid)	Colorless
Odor	Characteristic, pungent
Melting point	−103.9° F. (−75.5° C.)
Boiling point	14.0° F. (−10.0° C.)
Density of liquid at 80° F.	(85.03 lbs. per cu. ft.)
Specific gravity at 80° F.	1.363
Density of gas at 0° C. and 760 mm.	2.9267 grams per liter (0.1827 lb. per cu. ft.)
Critical temperature	314.82° F. (157.12° C.)
Critical pressure	1141.5 lbs. per sq. in. abs.
Solubility	Soluble in water
Purity	99.9+% (by wt.) SO_2 (H_2O less than 0.01%)

*REG. U. S. PAT. OFF.



Send for your copy of "Liquid Sulfur Dioxide"—a treatise on the properties, characteristics, and industrial uses of Liquid Sulfur Dioxide—written by the Ansul Technical Staff.

ANSUL CHEMICAL COMPANY, MARINETTE, WIS.
Eastern Office 60 E. 42nd St. New York City

have been used satisfactorily for certain building purposes in Arizona.

Serious attention was first given to this rock in 1941 when L. L. Boyer conducted experiments on crude perlite mined near Superior, Ariz. As a result of experimentation since that time, suggested uses of exploded perlite include paint fillers, fertilizer absorbent, abrasives and soaps, filter aid, plastics filler and as a high-temperature industrial insulation. The Chemi-Cote Perlite Corp. is now enlarging its processing plant to take care of the increasing demand for this material.

PICKLING ACIDS

A SPECIALLY prepared acid cleaning and descaling compound has recently been developed by the Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. Containing addition agents for surface action and inhibition, the product, known as Pennsalt PM-90, is primarily used as a pickling bath concentrate in electroplating shops and as an acid cleaner for removing water scale from boilers and industrial equipment. Commercial quantities are available in 115 lb. returnable carboys.

ANTI-STICK COMPOUND

THE MOLDING of rubber goods requires that the mold faces be coated with some material which will permit the molded article to be removed without sticking to the mold. For a long time, Stanco, Inc., New York, N. Y., has marketed a product known as Dipex for this purpose, but its use was restricted to molding black or dark colored items.

Now a similar product, Dipex (Improved), is available which can be used in conjunction with white as well as black molded rubber articles. After wartime restrictions are lifted, the improved compound will be used in the molding of white and light colored articles, including rubber aprons and sheets, bathtubs for infants and other infants' articles, children's toys, hot water bottles, bathing caps, milking machine parts and white-wall tires.

The new anti-stick agent may be used in concentrations of from 1 to 15 percent in water solutions and may be applied by spraying, brushing or dipping of the mold. With large and complicated mold faces, hand operated brush or spray may be best. The molds are ready for use, after a brief drying sufficient to eliminate excess water. According to the manufacturer, there is no build-up of carbonaceous or other residual material which might impair the sharpness and clarity of designs in the mold.

Dipex (Improved) contains approximately 55 percent petroleum sulphonates, the balance being water. It is sold in solution of paste consistency.

DIGLYCOL CARBONATES

BUTYL DIGLYCOL carbonate, butoxyethyl diglycol carbonate, and phenyl diglycol carbonate are new colorless organic ether-esters of low volatility recently made available by the Columbia Chemical Div., Pittsburgh Plate Glass Co., Pittsburgh, Pa. Their properties suggest that they may be used to advantage as plasticizers, high-boiling solvents, and softening agents,

Plaintiff's Exhibit No. 6

Reissued May 15, 1934 **Re. 19,166**

UNITED STATES PATENT OFFICE

19,166

FILTER AID

Harry S. Thatcher, Oxnard, Calif., assignor, by mesne assignments, to Celite Corporation, New York, N. Y., a corporation of New York

No Drawing. Original No. 1,632,458, dated June 14, 1927, Serial No. 46,850, July 29, 1925. Application for reissue February 23, 1934, Serial No. 712,604

16 Claims. (Cl. 210—203)

This invention pertains to a filter aid or filtration medium produced in accordance with the herein disclosure regarding the physical properties of such aid.

An object of this invention is to disclose the physical characteristics of a filter aid which is capable of giving a high rate of flow or volume efficiency and at the same time gives good clarification or quality efficiency. A further object is to place limitations upon the particle sizes to be utilized in manufacture of such filter aids.

1 The act of filtration pertains to the removal of solids from liquids and may be called clarification. Clarification may be defined as a filtration involving the removal of a small quantity of suspended matter, such as is commonly termed turbidity and which may only amount to a few per cent of the weight of the liquid or possibly only a fraction of one per cent. In some cases the suspended matter may be very fine and the material removed may be of microscopic size. The art of filtration may also embrace those filtration processes in which certain solid suspended matters may be or may not be removed, but in which the fluid being filtered is also acted upon by the filtering material either chemically 2 or physically or in both manners. For example, the filter aid may merely decolorize or adsorb coloring matter from the fluid, or, in the filtration of emulsions, the filter aid may upset the equilibrium present in the emulsion so that although both or all constituents pass through the filter aid, they settle, or separate gravitationally after such filtration.

My invention pertains, particularly, to the particle size of filter aids or materials used in filtration, as defined above. The particle size of materials for filtration has not received the attention of investigators, but I have found that this property has an important bearing upon the effectiveness of such materials. For example, it is well known in the art that filtration of water may be accomplished by means of sand, but this filtration is rather elementary and does not remove very finely divided particles in suspension because of the large porosities existing between the individual particles composing the filter bed. Large porosities increase the rate of flow through the filter bed but at the same time they allow the finer suspended impurities to go through. A filter aid composed of very finely ground material may give clarity in the resulting filtrate but generally this condition is accompanied by a reduction in the rate of flow. The investigations which result in my invention were directed to the production of a filter aid which would give a high rate of flow and at the same time clarity.

Furthermore, filtration is not merely the mechanical removal of solid suspended impurities by passing the liquid carrying such impurities through a filter bed, but very often is a chemico-physical problem, as in the case of decolorization and treatment of emulsions cited above. In the latter instances, and also in mechanical filtration, to a certain extent, the effectiveness of the filter aid is dependent upon the surface area of the material. This surface area of a finely divided solid material increases very rapidly with the reduction of particle size and may be judged from the following:

Increase in surface area by subdividing a centimeter cube

Length of edge	Number of cubes	Total surface
		Sq. cm.
1 cm.	1	6
1 mm.	1,000	60
0.1 mm.	1,000,000	600
0.01 mm. or 10 microns	1,000,000,000	6,000
0.001 mm. or 1 micron	1,000,000,000,000	60,000

This increased surface area affects the effectiveness of the filter aid as in many cases adsorption of impurities in the liquid being treated by means of such aid plays an important part. I again have reference to the decolorizing processes before mentioned, in which materials such as carbons, charcoals, fuller's earth and decolorizing clays are used. It is, therefore, seen that it is desirable to have a filter aid composed of very fine individual particles, and at the same time retain or enhance the rate of flow through the filter bed composed of such material. I have found that this may be obtained by preparing a filter aid having particles ranging in sizes from a relatively coarse particle to very fine, in such proportions that they do not form a mass of maximum density upon the filtering surfaces of the filtering apparatus. Whatever reasons or theories underlie my preferred grading of particle sizes in a filter aid is of no moment, however, and I do not wish to limit myself to any one theory, my invention relying upon the facts disclosed by my investigations, namely, that a filter aid containing a certain maximum per cent of large and a certain maximum per cent of small particles produces a desirable filter aid as hereinafter disclosed.

Re selection

It is admitted that filter aids have been used heretofore in a finely divided condition but no work has ever been done to place limitations upon the fineness of the material used for this purpose. Indiscriminate grinding of a filter aid such as, for example, diatomaceous earth, does not produce a filter aid which is capable of giving a high rate of flow and clarity in the resulting filter aid. When such grinding or disintegration, however, is carried out in accordance with my invention so as to produce a material having particle sizes falling within the limitations hereinafter disclosed, the rate of flow obtained is higher than that obtained with other filter aids and the clarity is excellent, that is, even the very finest suspended or colloidal particles are retained by such filter aid.

112 TMM

I have found that when inorganic solid materials adapted for manufacture of filter aids, such as diatomaceous earth (otherwise known as kieselguhr, tripoli, fossil flour, infusorial earth, or molar whether calcined or uncalcined), are so disintegrated or crushed that not more than 10% of the disintegrated product is left on a 150 mesh screen, not more than 50% or less than 15% of the material, by weight, is composed of particles having an average dimension of about 10 microns (0.01 mm.) or larger and contain not more than 25% by weight of particles smaller than 1 micron (0.001 mm.) in mean dimension, or diameter, such filter aids will show a high rate of flow and at the same time give good clarification.

Because of the difficulty of determining the exact amount of finely divided material coarser than or smaller than any of the sizes hereinbefore mentioned, my invention should not be held strictly to the limitations disclosed. It is to be remembered that particles one micron in diameter are in the order of twelve thousand meshes to the linear inch. The determination of particle sizes may be made either by sedimentation in a suitable liquid or by means of microscopical examination or by any other suitable means, but I have found the first two methods preferable.

The above specification for the fineness of filter aids needs a certain amount of explanation. I have found that there are active and inactive constituents in filter aids, the inactive particles being composed of very fine isotropic particles generally having a diameter of about one micron, such particles filling the voids between larger particles and thereby reducing the rate of flow through a filter cake. A certain amount of these fine particles may be necessary, however, for the elimination or retention of very fine, suspended, or colloidal impurities present in the liquid being filtered. I have also found that it is well to remove very large particles which settle rapidly in the liquid being filtered and thereby become inactive as filter aids.

Most of the particles composing the filter aids are anisotropic and I have found that spicular particles are particularly useful as filter aids. It is readily conceived that a filter cake composed of anisotropic or spicular particles will contain a much higher percentage of voids than a filter cake composed of perfectly spherical or cubical particles. It will be also seen that by means of the above specifications I have placed limits as to the maximum and minimum percentage of particles that are relatively coarse and inactive and also a maximum limitation on the amount of very fine particles which are practically inactive, so that the largest proportion of the filter aid is composed of intermediate sizes, such sizes being most effective.

In determining the particle sizes, of a diatomaceous earth filter aid having a specific gravity of 2.1, I have followed the following procedure, which is representative of the method. Two grams of the diatomaceous earth used in one test was placed into suspension in 100 cc. of distilled water and shaken continuously for five minutes, the suspension was then placed in a sedimentation cell containing a sedimentation plate or watch crystal suspended in the cell from a balance arm of an analytical balance. The material settled from the suspension onto the plate and the weight of the settled material was observed at convenient intervals. At the expiration of say 24 hours the final reading was taken and the amount of material still remaining in suspension was determined by evaporating the liquid and calcining the residue.

The continual change in the buoyant effect on the plates was taken into account by making a graph, assuming that the weight of the plate itself varies uniformly according to the amount of the material in suspension at any given time. The percentage settled was plotted against the time and the time intervals required for the particles of the various sizes to settle was determined from Stokes' law. Tangents drawn to the curve at the point calculated intercept on the percentage settled axis, lengths or percentages equal to the weight of the various size particles corresponding to the size and time divisions selected.

In determining the time required for settling by means of Stokes' law it will be seen that particles of spherical shape are taken into consideration. Inasmuch as there are practically no spherial particles in most filter aids, the final results obtained represent percentages or amounts of particles having approximately the same mass but not the shape of the particles reported. For example, using a specific gravity of 2.1, particles of about 10 microns in diameter will settle at a rate of 0.36 centimeter per minute in distilled water at 20° C. in accordance with Stokes' law. All particles which settle at this rate from a diatomaceous earth filter aid under the same conditions are reported as particles having a diameter of about 10 microns, although in fact they may be, and very often are, anisotropic particles of from abopt 15 to 25 microns long, depending on their cross section. Furthermore, the relationship of mass to shape is not perfectly true inasmuch as an anisotropic particle of the same mass as a spherical particle will not necessarily settle at the same rate because of stream line and surface effects. Isotropic particles such as those of 1 micron and finer settle under the same conditions at the rate of 0.0036 centimeter per minute. Naturally, particles which settle at a rate slower than 0.0036 centimeter per minute are smaller than 1 micron. A method for determining the particle sizes is described in The Svedberg's "Colloid Chemistry", pages 136–146 (A. C. S. Monograph).

Inasmuch as various grades of diatomaceous earth vary in specific gravity from 1.9 to 2.3 the rates of settling given above are only a mean between the limits here given. For example, 10 micron particles of 1.9 gravity settle at a rate of about 0.30 cm. per minute, while 10 micron particles of 2.3 gravity settle at about 0.42 cm. per minute.

My invention may, therefore, be defined as follows: A filter aid composed of particles so that not more than 10% of material remains on a 150 mesh screen, not more than 50% or less than 15% of material by weight settles at an appreciably higher rate in distilled water at 20° C. than about 0.36 cm. per minute, and contains from none to at most 25% by weight of particles which settle in distilled water at 20° C. at a rate of about 0.0036 cm. per minute or slower. This interpretation includes anisotropic particles behaving as spherical particles of 10 microns and 1 micron diameter.

Complete particle size analysis of two diatomaceous earth products which have been used in filtration with excellent results were made in accordance with this invention and are as follows:

[illegible]

No. 1		No. 2	
Percent by weight of material	Particle size	Percent by weight of material	Particle size
Percent	*Microns*	*Percent*	*Microns*
40	10	28	10
13	8-10	6	8-10
13	6-8	8	6-8
15	4-6	13	4-6
14	2-4	20	2-4
4	1-2	11	1-2
1	1	14	1

3-75

The above products, and others of intermediate particle size analysis, are preferred examples of this invention.

The desirability of manufacturing a filter aid having particles graded in accordance with my invention may be seen from the following data on actual filtration tests using a 60° Brix sugar solution and a small pressure filter press. All of the filter aids were made of diatomaceous earth and were added to the solution to be filtered at the rate of 0.3% filter aid on weight of sugar in the solution. The pressure was increased at the same rate in all tests and the temperature of liquid being filtered was kept at 80° C.

Particle distribution	My no. 2 product	Q.	S.
Larger than 10 microns	28%	3%	55%
Between 10-6 microns	14%	8%	36%
Between 6-1 microns	44%	30%	8%
Smaller than 1 micron	14%	59%	1%
Rate of flow gallons per sq. ft. per hr.	4.5	1.44	10.5
Rate of flow, percentage	100%	32%	232%
Clarity of filtrate	Brilliant.	Dirty.	Very dirty.

The filter aid designated as Q was milled very fine and, therefore, contained more than 25% of 1 micron particles and gave both a low rate of flow and a dirty filtrate. The material designated as S having more than 50% of 10 microns or larger particles gave a very high rate of flow but did not retain any of the impurities present in the liquid being filtered and was, therefore, useless. These two materials do not fall within my particle size limitations and show by comparison the value of my invention.

The manufacture of diatomaceous earth filter aids, for example, in accordance with the above specifications may be most easily carried out by means of disintegrating machinery, such as swing hammer mills or impact disintegrators of suitable design, from which the disintegrated material is carried by pneumatic means to air separating machinery, such as cyclones or other conical separators. In such separators the coarser particles are removed and the gases discharging from such air separators are passed by means of fans, impellers, or other suitable blowers (which may also act as secondary disintegrators), to secondary cyclones or other air separators in which the very fine particles, or so-called dust, are removed. By regulating the disintegrating machinery, speed of fans and quantity of material being disintegrated, the particle size of the resulting product may be controlled within fairly well defined limits. In such disintegration, an air separation by the above described means is fairly well known in the mill industries. I lay no claims to the apparatus used in the production of my filter aid, and any suitable method of manufacture may be followed, provided the product has the particle size disclosed herein. Large scale water settling or washing processes, electrical precipitation processes, the use of electrolytes or coagulants or de-flocculating salts, etc. in the settling process of separation, may be employed in the manufacture of my product.

I claim:

1. A finely divided diatomaceous filter aid containing between 28% and 40% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, and less than 14% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 1 micron and smaller in diameter.

2. A finely divided diatomaceous filter aid containing between 28% and 40% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger in diameter, and less than 25% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 2 microns in diameter.

3. A finely divided diatomaceous filter aid containing between 28% and 40% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger in diameter, and less than 14% but more than 1% by weight of particles having the settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

4. A finely divided diamtomaceous filter aid containing between 28% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, and between 5% and 25% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 2 microns and smaller in diameter.

5. A finely divided diatomaceous filter aid containing between 28% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, and less than 25% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same

specific gravity smaller than 2 microns in diameter.

6. A finely divided diatomaceous filter aid containing between 28% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger in diameter, and less than 25% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 2 microns in diameter.

7. A finely divided diatomaceous filter aid containing between 28% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger in diameter, and less than 14% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

8. A finely divided calcined diatomaceous filter aid containing between 28% and 40% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, and between 5% and 25% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 2 microns and smaller in diameter.

9. A finely divided diatomaceous filter aid containing between 15% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger in diameter, and between 5% and 25% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 2 microns and smaller in diameter.

10. A finely divided calcined diatomaceous filter aid containing between 28% and 40% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger, less than 25% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 2 microns in diameter, and less than 14% but more than 1% by weight of particles having the settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

11. A finely divided calcined diatomaceous filter aid containing between 28% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, and less than 14% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

12. A finely divided calcined diatomaceous filter aid containing between 15% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger in diameter, and less than 14% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

13. A finely divided calcined diatomaceous filter aid composed principally of irregularly shaped, anisotropic particles containing between 28% and 40% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, and between 5% and 25% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 2 microns and smaller in diameter.

14. A finely divided diatomaceous filter aid composed principally of irregularly shaped, anisotropic particles containing between 28% and 40% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger, less than 25% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 2 microns in diameter, and less than 14% but more than 1% by weight of particles having the settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

15. A finely divided diatomaceous filter aid composed principally of irregularly shaped, anisotropic particles containing between 28% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, and less than 14% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

16. A finely divided diatomaceous filter aid composed principally of irregularly shaped, anisotropic particles containing between 15% and 50% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 10 microns and larger in diameter, between 42% and 66% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity 6 microns and larger in diameter, and less than 14% but more than 1% by weight of particles having settling characteristics of spherical particles of same material and of the same specific gravity smaller than 1 micron in diameter.

HARRY S. THATCHER.

Plaintiff's Exhibit No. 8

TABLE V

BULK AND CAKE DENSITIES OF AGGREGATES

	Aggregate Bulk Density lbs./cu. ft.	% on 150 Mesh Screen	Filter Aid Cake Density lbs./cu. ft.
Perlite	3.3	5.4	16.9
Perlite	5.3	3.0	21.5
Perlite	8.5	2.6	36.0
Perlite	14.0	4.0	48.0
Vermiculite	6.5	3.0	47.0

Plaintiff's Exhibit No. 9

PROPERTIES OF FILTER AIDS USED IN CHARTS A & B

Particle size, Microns Sample No.	0-3	3-5	5-10	10-20	20-40	+40	Aggregate Bulk Density Lb./cu. ft.	Yield %*
I	13.0	16.5	42.0	20.0	7.0	1.5	2	95+
II	9.5	14.5	41.0	24.0	7.0	4.0	3¼	60+
III	12.0	17.0	42.0	19.5	8.5	1.0	8	47

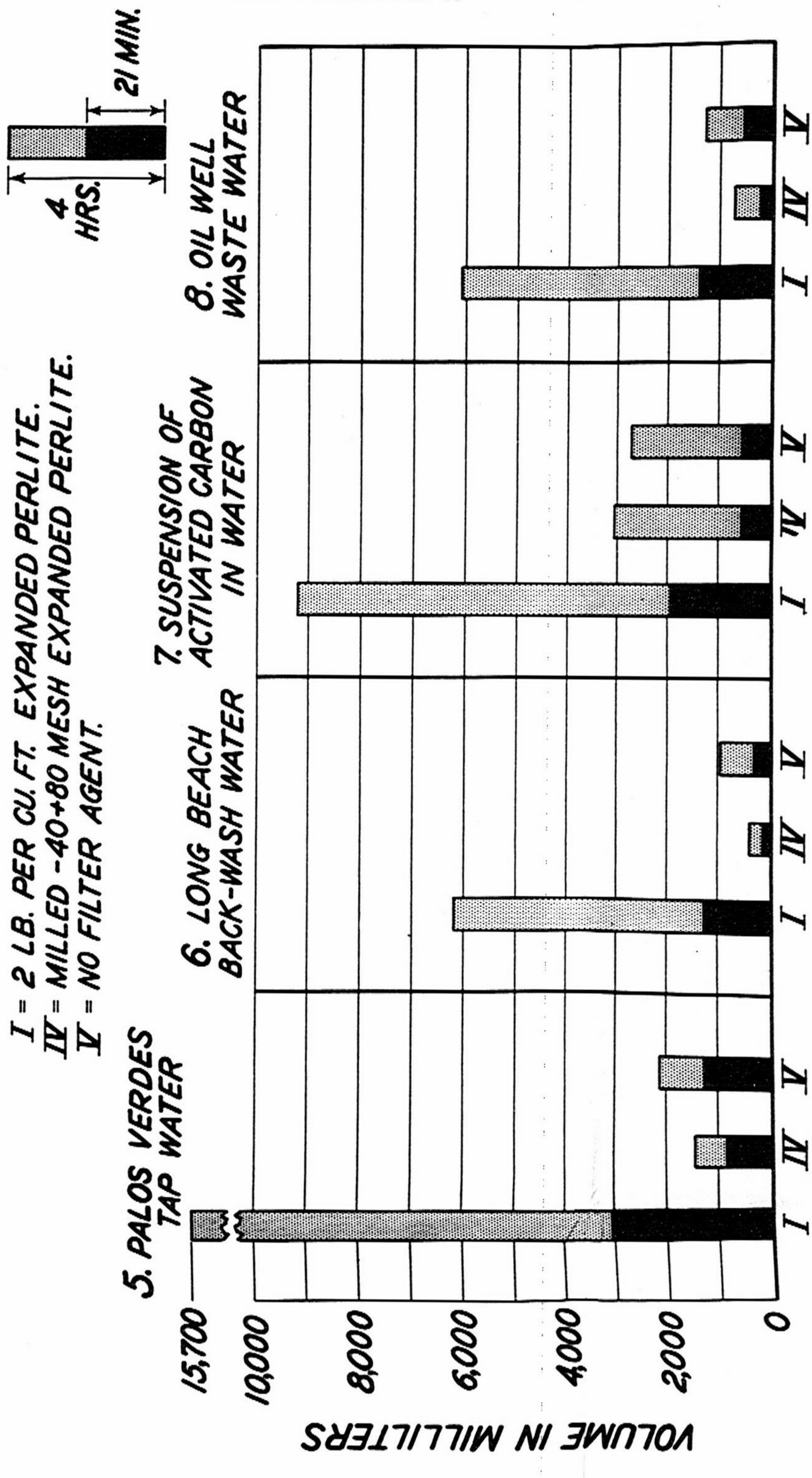
---

* Percent by weight of filter aid from the original aggregate.

Plaintiff's Exhibit No. 10

Exh. 10

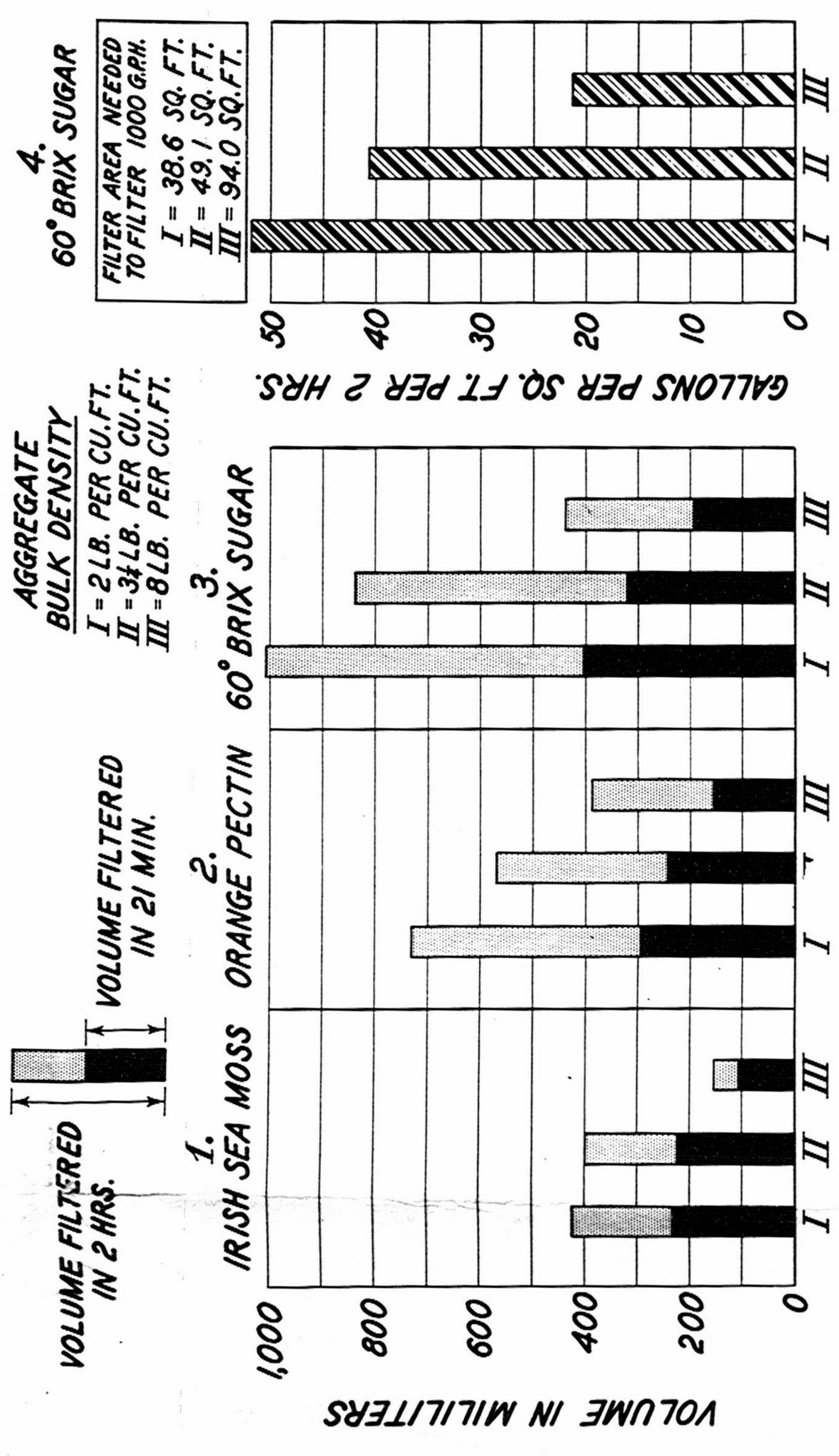
B. COMPARISON OF PRODUCT OF THE INVENTION WITH -40+80 MESH MILLED EXPANDED PERLITE



Plaintiff's Exhibit No. 11

Exh. 11

A. EFFECT OF AGGREGATE DENSITY ON FLOW RATE OF PERLITE FILTER AIDS



BRIEF FOR APPELLANTS

IN THE

United States Court of Appeals

For the District of Columbia Circuit

United States Court of Appeals
For the
District of Columbia Circuit
FILED FEB 8 1957
Joseph W. Stewart
CLERK

No. 13,624

Great Lakes Carbon Corporation, *Appellant*

v.

Robert C. Watson, Commissioner of Patents, *Appellee*

Appeal from the United States District Court for the District of Columbia

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STATEMENT OF QUESTIONS PRESENTED

The questions presented are:

(1) Did the trial court commit reversible error of fact and of law in holding claim 17 to be unpatentable in view of an erroneous interpretation of prior art teachings with respect to particle size distribution; his failure to recognize that a suggested use of expanded perlite as filter aid was untrue and made inadvertently or through ignorance; and, further, his failure to take into account the critical nature of the limitations of the claims and the unexpected, unpredictable and superior results flowing from appellant's discovery as established by the evidence.

(2) Did not the trial court commit reversible error in failing to hold that the differences between the subject matter sought to be patented and the prior art were such that the subject matter as a whole would *not* have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains, with only the references before him and without the aid of the application in suit, in view of all of the evidence establishing the inapplicability and/or unreliability of the prior art; the critical limitations of the claim; the discovery of a new source and process for making filter aid; the unexpected results obtained and the superior utility of the resultant product.

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IN THE

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

No. 13,624

GREAT LAKES CARBON CORPORATION, *Appellant*

v.

ROBERT C. WATSON, COMMISSIONER OF PATENTS, *Appellee*

Appeal from the United States District Court for the District of Columbia

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BRIEF FOR APPELLANTS

JURISDICTIONAL STATEMENT

(1) The appeal arises under Title 28 USC 1291. Jurisdiction is admitted.

(2) The Bill of Complaint as amended is for issuance of a patent in accordance with the provisions of the Patent Act of 1952, 35 USC 145, 66 Stat. 792, for the invention embraced by claim 17 of the application of John W. Kenney, Jr., and Armand R. Bollaert, Serial No. 241,398, filed August 11, 1951 (App. 2-10).

STATEMENT OF THE CASE

A. Proceedings Below

The application in suit was filed August 11, 1951 as a continuation-in-part of an earlier application filed August 5, 1946, Serial No. 688,430, now abandoned. The Commissioner of Patents has refused to grant a patent on the present application (App. 71), the rejection by the Primary Examiner having been sustained by the Patent Office Board of Appeals (App. 73). The assignee elected to go to the District Court for the District of Columbia in lieu of an appeal to the Court of Customs and Patent Appeals, under the Patent Laws of the United States and specifically under 35 U.S.C. 145 (App. 2).

The original complaint contained a number of claims (App. 3-7). The complaint was amended with the consent of the appellee to dismiss all of the claims except claim 17 (App. 9). Claim 17, originally dependent upon claim 21, was rewritten in the usual independent form, without change of scope (App. 10), and is the sole claim to be considered.

The rejection of the claim was on a combination of three references, and upon res adjudicata. The latter rejection was ruled out by the Trial Court at the opening of the trial (App. 23, 24), and the case was decided on the basis of the combined teachings of the prior art.

In a memorandum dated June 20, 1956 Judge Matthew F. McGuire, District Judge, stated he was unable to find in this claim any advance over the prior art that rises to the dignity of invention (App. 11). Findings of fact were subsequently filed without opinion, together with an order dismissing the complaint under date of August 23, 1956 (App. 12-14). On October 22, 1956, the plaintiff-appellant filed a Notice of Appeal (App. 14). The appellant and the appellee stipulated the record on appeal, and agreed upon the contents of the joint appendix. Plaintiff's original exhibits 3(a) through 3(f) and exhibit 7, which were photomicrographs, were transmitted, under motion, to be used as exhibits in the proceedings in this Court.

B. The Invention

The invention comprises a process for making a filter aid from expanded perlite of a critical low bulk density of one to about six pounds per cubic foot (App. 48). Filter aids, as precisely defined in the application, are finely divided powders having certain unique shape characteristics which make them useful in aiding the mechanical removal of finely divided colloidal and/or mucilaginous suspensoids from a wide variety of liquids such as raw sugar solutions, etc. for the purpose of clarifying them. Usually small proportions of finely divided filter aid are mixed with the liquid which is then passed through a permeable filter or septum upon which the finely divided filter aid is retained. Another method is to precoat the filter with the filter aid and pass the liquid through it, with or without added filter aid in suspension (App. 48-50).

These distinguish from the type of filtration in which liquid is passed through relatively thick beds of granular materials, such as sand, expanded perlite, etc. without previous addition of solids to aid the filtration (App. 49-50, 66-70). This is a method commonly used to filter water, for example, in municipal water plants. It is likewise distinguished from treatments in which dissolved impurities, as distinguished from suspensions, are removed by adsorption with fuller's earth, activated carbon and the like (App. 26).

Perlite is a volcanic glass containing bound water. As used in the application the term embraces a number of volcanic glasses having closely related properties such as perlite itself, pumicite, obsidian, pitchstone, pumice, certain heat expandable volcanic ashes, and the like. Upon rapid heating to incipient fusion, for example, by dropping granular ore into a flame, it "expands", "explodes" or "pops" to form particles of pumice-like structure. Expanded perlite has sometimes been described as "artificial" or "man-made" pumice. Each particle is made up of a honeycomb of many minute sealed glass bubbles having thin glassy walls (App. 50-51, Plaintiff's Exhibits 3(d), (f)). It is used, to a large extent, as thermal insulating material and as an aggregate to replace sand in light weight gypsum plaster and concrete. These uses depend upon the multicellular bubble-structure, the generally spherical shape of the particles, and the bulk density of the material (App. 79, 81).

The appellant discovered that if expanded perlite, having an apparent or bulk density in the critical range of about one to about six pounds per cubic foot were comminuted so as to destroy the bubbles leaving only fragments of the walls thereof, and if fragments were selected of a particle size falling within the range set forth in the claim, highly useful filter aids are produced. The claim on appeal is as follows:

> "17. A process for producing a filter aid from artificially expanded, low bulk density, multi-cellular perlite aggregate which comprises comminuting perlite aggregate having a bulk density between about one and about six pounds per cubic foot to produce a fragmental product whose particles are substantially less than 149 microns in size and which contains not more than about 40% by weight of particles smaller than three microns and not more than 20% by weight of particles larger than forty microns in size, the milled product further having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids." (App. 10, 12)

The appellant made, and exemplifies in the application a variety of grades of filter aids in accordance with the claimed process. These are useful in solving a variety of different commercial filtering problems (App. 56-62). These materials are true filter aids, serving the sole purpose of aiding in the mechanical removal of suspended solids from liquids (App. 28).

Up to the time the invention was made, diatomaceous earth was the only known material of inorganic origin which was a filter aid or from which filter aid could be made, within the meaning of the term as defined in the application (App. 25-27). Diatomaceous earth is composed of the siliceous fossil remains of prehistoric algae or diatoms, and is a filter aid in its natural state (App. 29, Plaintiff's Exhibit 7). The loosely consolidated earth is subdivided and sized to improve its performance (App. 27), but without destroying the skeletal forms of the diatoms (App. 30). The 10,000 or so known species are of a variety of shapes, needles, flat disks, boat-shaped, etc. (App. 29, 30, and Plaintiff's Exhibit 7). Because of the numerous different shapes in which nature formed them, they do not pack well and hence form low density, porous filter cakes (App. 30).

Perlite or expanded perlite is not a filter aid (App. 17-21, 27, 39, 44, 45). It can be made into a filter aid by destroying its physical structure in accordance with the claim. Not all expanded perlites can be so used. To be useful the exploded perlite from which filter aid can be made must have a bulk density in the range of one to six pounds per cubic foot (App. 34, 35, 40-43, 87, 90).

Only by processing expanded perlite of this critical density are particles produced of such shape as to form a filter cake of the requisite porosity and density to effectively clarify turbid liquids (App. 34). They consist of very thin, irregularly shaped bits of glass in no way resembling diatoms (Plaintiff's Exhibits 3(a), (b), (c) and 7). Expanded perlite weighing more than about six pounds per cubic foot, yields materials producing cake densities in excess of the 20-24 pounds per cubic foot which is the maximum useful density (App. 34, 35).

Materials which are spherical in form, such as sand, activated carbon, decolorizing clays, etc. and expanded perlite itself, are not filter aids as the term is used in the application. They have only 25-30 percent void space between the particles as opposed to 85-90 percent for a true filter aid (App. 29). The voids within expanded perlite are sealed or partially sealed and are not available to aid in filtration.

There is no relationship chemically, physically, in appearance, or origin between diatomaceous earth and perlite or filter aid made from perlite. As will be developed in the argument by comparison of the teachings of the Thatcher patent (App. 83) and of the application in suit (App. 48+), the criteria as to particle distribution are not the same for perlite and for natural diatomaceous earth.

The Trial Court in its findings makes no mention of these facts.

C. The References

The combined teachings of three references are relied upon by the Appellee and by the Trial Court in refusing the patent. The item entitled "New Insulating Material" from the Compressed Air Magazine (App. 79) briefly discloses grinding expanded perlite to 40-80 mesh, which does not destroy its cellular character (App. 46), and says that this may be used for filtering water, that is, as a filter. The item entitled "Thermal Insulation From Perlite Rock" from the Chemical and Metallurgical Engineering Magazine [hereinafter referred to as Chem. and Met.] (App. 81, 82) also discloses expanding or exploding perlite to form particles made up of sealed bubbles and contains the bare *suggestion* that a possible use is "filter aid".

These articles are anonymous news items from magazines, the function of which is advertising (App. 20-23). The items are directed to the insulating properties of expanded, cellular perlite, and are so titled.

The Thatcher reissue patent (App. 83) deals with diatomaceous earth with no mention of perlite. This patent uses the term "filter aid" in a broader or looser sense than it is defined in the application. However, it distinguishes between materials which merely clarify liquids by mechanical removal of suspended solids (diatomaceous earth), and adsorptive materials such as clays and activated carbon used to improve the color of liquids by removal of dissolved impurities. They frequently require the use of a filter aid to remove them from the liquid by what he terms "chemico-physical" means (App. 28). Neither diatomaceous earth nor perlitic filter aids possess such properties.

In preparing diatomaceous earth for use in clarifying commercial and industrial liquors care is taken that no fundamental change is brought about in the physical form of the diatoms, as the patentee recognizes (App. 83, line 5).[1]

In his findings, the Trial Court relied entirely upon the combined teachings of the references.

STATUTES AND RULES INVOLVED

35 USC 100 Definitions

"(a) The term 'invention' means invention or discovery."

"(b) The term 'process' means process, art or method—."

35 USC 101

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

---

[1] The 9th Circuit case of *Celite Corporation* v. *Dicalite Co.,* 96 F. (2d) 242, beginning near the bottom of the second column of page 244, and through the second full paragraph of page 246, discusses the nature of a "filter aid" as distinguished from a "filter". It casts considerable insight upon the processing of diatomaceous earth to produce efficient filter aids. It will be gleaned from this discussion and from the discussion of the Court relating to the prior art and merits of the invention thereunder that diatomaceous earth is in its natural state a filter aid. Its effectiveness can be improved by calcining in the presence of a flux to agglomerate the fine particles, and possibly to effect other changes, but without destroying the natural structure of the diatoms.

35 USC 103

"A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made."

Rule 52(a) Federal Rules of Civil Procedure

" . . . Findings of Fact shall not be set aside unless clearly erroneous and due regard shall be given to the opportunity of the trial court to judge the credibility of witnesses."

Jurisdiction being admitted it is unnecessary to quote from 28 USC 1291 or 35 USC 145.

STATEMENT OF POINTS

1. The Court erred in the application of rules of law in holding that nothing in the claim rises to the dignity of invention, in view of appellant's evidence as to criticality and unobvious results; and the character of the art relied upon including the paucity and inapplicability of the teachings therein.

2. The Court erred as a matter of law in combining incidental and erroneous suggestions relative to filtration from news items devoted to the non-analogous art of thermal insulation, with teachings relating to natural diatomaceous earth filter aid, to negative patentability.

3. The Court erred as a matter of fact in holding that the Thatcher reissue patent teaches the use as a filter aid of diatomaceous filter particles *graded in size substantially as called for by the claim,* and hence erred as a

matter of law in holding that it was not a matter of invention to grind and grade expanded perlite to the values set forth in claim 17.

4. The Court erred as a matter of fact and law in failing to recognize that it was a patentable discovery to substantially completely destroy the cellular structure of expanded perlite having a critical bulk density of one to six pounds per cubic foot in order to produce particles of a shape requisite to a useful filter aid. Despite the fact (1) that the art teaches nothing more than the use of *cellular* perlite in filtration; (2) that it contains no suggestion that the bubble or cellular structure should be destroyed, but rather that it should be preserved; (3) that expanded perlite is not a filter aid regardless of particle size; and (4) that even when ground, the expanded perlite of the prior art does not yield particles of the shape requisite to produce useful filter aid, although the particle size is substantially identical with useful filter aids made according to the claimed process, the Court found nothing unobvious in appellant's discovery.

5. The Court erred as a matter of fact and law in failing to note the unexpected and unobvious result obtained by grinding one to six pound expanded perlite, a material not initially a filter aid, to make a filter aid five to six times as effective as Thatcher's best diatomaceous earth product.

6. The Court erred as a matter of law in failing to hold, based upon the evidence before it, that the subject matter of the claimed process would *not* have been obvious to a person having ordinary skill in the art to which the discovery pertained, at the time it was made and without the benefit of the appellant's disclosure.

7. The Court erred as a matter of fact in failing to recognize the several unexpected, unpredictable and un-

obvious results flowing from the practice of the claimed process, and as a matter of law in failing to hold that this constituted a patentable discovery.

8. The Court erred in holding the discovery embraced by the claim to be unpatentable.
9. The Court's errors amount to reversible error.

SUMMARY OF ARGUMENT

A discovery is patentable unless the subject as a whole would have been obvious, from the prior art, at the time the discovery was made to a person having ordinary skill in the art to which the subject matter pertains (35 U.S.C. 103). This legislation restored the standard for determining patentability to what it formerly was. *L-O-F Glass Fibers Company and Everett J. Cook* v. *Robert C. Watson,* 228 F. (2d) 40, 97 App. D.C. 69. Therefore, to negative patentability the art must relate to the subject matter and must teach the substance of the invention to a person of ordinary skill—not an expert or a great scientist, or even one who excels his fellows in the field, so that he may practice the invention without reference to the application.

Although the filter aid art is a specialized field in which comparatively few people have skill and is only a part of the broader field of filtration, the appellee has been forced to rely upon two anonymous news items dealing with *thermal insulation.* Filtration is mentioned only in passing; and then with a maximum of brevity—as a *suggested* use for expanded perlite of bubble structure.

The very character of these publications—news items in magazines devoted to advertising—their anonymity—the paucity of disclosure—the field far removed from the filter aid art—, reveals the state of the art prior to appellant's discovery, magnifies rather than depreciates appellant's accomplishment. Likewise it emphasizes the extremes to which the appellee was put to find something on which to base a ground of rejection.

Yet, from his decision (there was no opinion) the Trial Court must have considered that one of ordinary skill in the subject matter of making filter aids would have found the problem and its solution to be obvious in view of the teachings of the Thatcher patent relative to diatomaceous earth filter aids. The Court must have considered that a person of ordinary skill, seeing these references and with no knowledge of the application in suit, would have said "This is what I have been looking for. The answer is obviously all here."

The evidence is to the contrary.

1. Expanded perlite is not a filter aid regardless of particle size. The statement in Chem. & Met. must therefore have been made inadvertently, by mistake or through ignorance of what filter aids are.
2. Perlite and diatomaceous earth bear no resemblance to each other whether in origin, chemical composition, physical structure, appearance, or particle shape.
3. Diatomaceous earth is a natural filter aid. No other inorganic material was known which was a filter aid or from which filter aid could be made, whether by grinding and sizing or by any other method.
4. Thatcher asserts that the particle size distribution of natural diatomaceous earth is of the utmost criticality and that the ranges taught must be rigidly adhered to. While, contrary to the finding of the Court, information is lacking on which to base an absolute comparison of particle distribution, eleven of twelve effective filter aids disclosed in the application would be expected to fall into the category of useless materials if Thatcher's teachings were applicable to perlite filter aids.
5. Filter aids made according to claim 17 are five to six times as effective as the best natural diatomaceous earth filter aid shown by Thatcher. Thatcher's

products are at best of limited utility, being confined to low flow rate systems. In sharp contrast to this, perlite filter aids useful in systems requiring high, medium or low flow rates can be made in accordance with the process of claim 17.

6. The expanded perlite of the references (7.5-12 lb/cu. ft.) upon grinding to destroy its cellular structure does not yield particles of a shape requisite to a useful filter aid, regardless of particle size.

7. The bulk density limitation of one to six pounds per cubic foot has been demonstrated as critical to the production of particles having the shape requisite of a useful filter aid. Expanded perlite of this density is not disclosed in the references.

Yet the Court must have considered that all of these facts would have been obvious from the references to a person of ordinary skill in the art of making filter aids at the time the discovery was made, and without guidance from the application in suit. Appellant submits that the process is neither taught nor suggested by the prior art. Unexpected, unpredictable and superior results obtained are evidence that the discovery is unobvious and hence patentable. They are of a character such that the accomplishment is dignified rather than depreciated by the prior art. The Trial Court's error in failing to take this into account and to correctly apply the law to the facts, should be corrected.

THE ARGUMENT

A. THE CONCLUSIONS OF THE TRIAL COURT ARE NOT BINDING ON THIS COURT UNDER THE PROVISIONS OF RULE 52(a) OF THE FEDERAL RULES OF CIVIL PROCEDURE

The questions confronting this Court are primarily questions of law or of the application of rules of law to the facts. Any purely fact question is of a nature such that this Court is in equally as good a position to evaluate as was the Trial Court. Although the Trial Court has denominated certain of its findings as being of fact, Findings No. 6-10 inclusive (App. 13) are actually conclusions of law.

Questions of patentability and invention are now generally regarded as questions of law. *Glitsch & Sons, Inc.* v. *Wyatt Metal & Boiler Works,* 224 F. (2d) 331; *Great Atlantic & Pacific Tea Co.* v. *Supermarket Equipment Corp. et al.,* 340 U.S. 147, 71 S. Ct. 127; *Kwikset Locks, Inc.* v. *Hillgren,* 210 F. (2d) 483; *Graver Tank & Mfg. Co., Inc. et al* v. *Linde Air Products Co.,* 339 U.S. 605; 70 S. Ct. 854. Conclusions of law are not binding on the appellate court. *United States* v. *U. S. Gypsum,* 333 U.S. 364, 394, 395; 68 S. Ct. 525. Nor is the Court bound by Rule 52(a) where there has been an erroneous application of rules of law to the facts. *United States* v. *U. S. Gypsum, supra.*

B. THE CLAIM IS PATENTABLE BECAUSE THE SUBJECT MATTER WOULD NOT HAVE BEEN OBVIOUS TO A PERSON HAVING ORDINARY SKILL IN THE FILTER AID ART

Since this case involves the question of patentability over a combination of prior art references, the question to be decided is whether the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. (35 U.S.C. 103)

A person skilled in the art or "having ordinary skill in the art" has been defined by numerous authorities. He is one having only ordinary and fair information and skill in the relevant art or science, not one who excels his fellows or who is an eminent scientist or even an expert in the relevant art. Section 103 restores the standard of invention to what it was twenty or more years ago. A leading case is *Lyon* v. *Bausch & Lomb Optical Co.,* 224 F. (2d) 530; Cert. Denied, 76 Sup. Ct. 193; Rehearing Denied 76 Sup. Ct. 341, which was referred to with approval by this Court in *L-O-F Glass Fiber Co. et al.* v. *Robert C. Watson,* 228 F. (2d) 40, 97 App. D.C. 69. To like effect are *R. M. Palmer Co.* v. *Luden's, Inc.,* 128 F. Supp. 672; *Helms Products, Inc.* v. *Lake Shore Mfg. Co., Inc.,* 228 F. (2d) 677.

C. THE ANSWER TO THE THRESHOLD QUESTION LIES IN THE PUBLICATIONS RELIED UPON

The manufacture and use of filter aids antedates this invention by many years. There are numerous patents and publications dealing with diatomaceous earth and the manufacture and use of filter aids therefrom, the Thatcher reissue patent (App. 83) being one.[2] No mention is made of perlite or any inorganic material other than diatomaceous earth from which a true filter aid can be produced, and indeed no such materials were known (App. 27). Thatcher affords no starting point and no guideposts.

Therefore, if the gap between this old though specialized art and the process of making a perlite filter aid is to be bridged, the foundation must be apparent from within the four corners of the Compressed Air and Chem. & Met. items. Failing this, the appellee's case must fall and the Trial Court's decision cannot be vindicated. A critical evaluation of the two publications is therefore in order.

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[2] This Court may take judicial notice of this fact since *Celite Corp.* v. *Dicalite, supra,* mentions five other U.S. and foreign patents dating back to as early as 1898, wherein processes are described for making filter aids by calcining diatomaceous earth with or without added fluxes. The flow rate characteristics are thus improved. Most present day diatomaceous earth filter aids are prepared in some such manner.

1. The Publications Are Entitled to Little Consideration

The two publications, Compressed Air Magazine (App. 79) and Chem. & Met. (App. 82), are directed to the non-analogous art of thermal insulation. Filtration is briefly mentioned as a suggested use for expanded perlite of cellular structure. The Chem. & Met. suggested use as filter aid could only have been made inadvertently or in ignorance of what a filter aid is (App. 19, 21), as will be developed below.

The character of these publications reveals the state of the art and is indicative of the extremes to which the appellee was put to find a basis for rejecting the claim.

The Compressed Air magazine is a periodical devoted to encouraging the use of compressed air and as an advertising means for equipment for compressed air use in the mining and construction industry, which might include the mining of perlite ore (App. 20). The anonymous article appears in a section devoted to news releases.

Chem. & Met. is a periodical devoted to a similar purpose, namely, advertising industrial equipment and products (App. 23). The ten items on the two pages cited mention some 20 companies, who thus receive a measure of free publicity for their products.

Neither item makes a pretense of being an authoritative presentation of scientific or technical data. Items such as the two relied upon are usually submitted from the advertising departments of companies wishing to call attention to a product or process, and are frequently edited or rewritten by staff members of the periodical, depending upon suitability, availability of space, etc. In addition to journalism, such staff writers may have some general technical background, possibly even in engineering or chemistry. It is highly unlikely, however, that they would be persons of even ordinary skill in each of the various matters on which they report so as to give such items an authoritative status. Thus, it is unlikely that such a person would be an authority in the numerous fields mentioned in the articles, which include soldering, electrical insulating laminates, transparent tape, protective coatings, metallic naphthenates, galvanizing finish, cleaning compound, pickling acids for electroplating, anti-sticking compounds, diglycol carbonates, thermal insulation materials including expanded perlite, paint fillers, fertilizer absorbents, abrasives and soaps, and plastic fillers, as well as the filtration of water and the field of filter aids. The test is not whether the article might have been written by a chemist or an engineer as the Court seemed to think when it said (App. 20):

> The Court: "Well, he says, 'As a result of experimentation,' he says it is suggested, 'As a result of experimentation since that time, suggested uses of exploded perlite include,' and my point is that if the article purports to be one written by a chemist, he has indicated that there has been some experimentation looking to the results mentioned here." (App. 20) * * * "This is written presumably by a Chemical Engineer." (App. 22)

Mere technical training does not connote skill in a particular art. This can only be acquired by special training or experience.

These periodicals do contain articles in various fields written by and appearing over the signature of men who are expert in their fields but the items under consideration are not of this character and hence cannot be viewed with utter reliance. Even the best reporters make mistakes. There are many opportunities for inaccuracies or misstatements to creep into items of this kind, these arising, *inter alia,* from unfamiliarity with particular subject matter. When inaccuracies occur, as they frequently do, they can only be discerned by a person sufficiently skilled in the particular art to recognize the mistake, or be demonstrated by failure of performance if subsequent experimentation is made. Dr. Leppla's testimony reflects that a person skilled in the art would have known expanded perlite is not a filter aid because of the spherical shape of the particles (App. 32, Plaintiff's Exhibit 3(d), (e) (f)), and would at once have recognized the untruth of the statement. Demonstration of the inaccuracy has also been made in this instance (App. 36, 39, 89).

Had the anonymous author actually done any experimentation as Chem. & Met. implies, he would himself have demonstrated the preposterousness of the suggestion that exploded perlite could be used as a filter aid, and the suggestion would never have appeared in print. Had the author been skilled in the art of filter aids and had he actually made one from perlite, he would neither have remained anonymous, nor chosen this avenue of announcing something to the world which no one had been able to accomplish for half a century.

Neither periodical is associated with a scientific organization and both are commercial ventures (App. 22, 23). Neither article contains sufficient information with respect to filtration so that a determination could be made as to the manner in which the cellular expanded perlite was intended to be or could be used.

The Patent Office rarely relies upon items of this character unless the teaching is clear and unequivocal. It is significant that during the years this application and its parent were before the Patent Office, the appellee has been unable to bring forward a better and more authoritative reference than news items of doubtful forebears and unknown parentage, and which, moveover, are devoted not to filtration but to thermal insulation.

2. This Type of Publication Is Entitled to be Considered for No More Than It Clearly Discloses

Any publication is entitled to be considered for what it would clearly teach to a person of ordinary skill in the art at the time the invention was made and without the assistance of the application in suit. This Court in the case of *Becket* v. *Coe,* 98 F. (2d) 332, 335 and 336, 69 App. D.C. 51, stated:

> "But when such a patent merely prophesies what can be done without setting forth that it has been done, or make claims for things not fairly disclosed in the specification, the foreign patent does not anticipate. [Citing Authorities] This court has said in Davies v. Coe, 1936, 65 App. D.C. 345, 346, 83 F. 2d 602, 603;
>
> > 'The disclosure of a foreign patent is to be measured not by what may be made out of it, but what is clearly and definitely expressed in it. [Citing Authorities]' "

A news item of the character relied upon by the appellee certainly stands in no better stead than the foreign patents to which the Court there made reference. This Court indicated as much in *Baldwin-Southwark Corporation et al* v. *Coe,* 133 F. (2d) 359, 76 App. D.C. 412, when it stated:

> "It is not competent to read into a foreign publication any information which it does not afford on its face. [Citing Authorities] The disclosure of a foreign publication must be so clear that it teaches the subject matter of the patent in suit without assistance from the latter. [Citing Authorities] Moreover, as was held in Atlantic Gulf & Pacific Co. v. Wood, 288 F. 148, 155 (C.C.A. 5th, 1923), quoting from Cimiotti Unhairing Co., 115 F. 524 (C. C. S. D. N. Y. 1902), a case itself based upon Seymour v. Osborne, 'A [foreign] document so obscure in its terminology that two conflicting theories may be deduced therefrom and supported by equally plausible arguments is too indefinite to be utilized as an anticipation.' These principles, although applied by the courts referred to in infringement suits, are equally applicable to proceedings to obtain a patent. [Citing Becket v. Coe, supra] This is to say, a foreign publication cannot operate to anticipate a claimed invention unless it meets these principles."

While these cases referred primarily to foreign publications or patents, it is not believed that the printed word originating in the United States is to be considered so profoundly omniscient that the same principles do not apply.

The Chem. & Met. item "suggests" exploded perlite as "filter aid", and defines exploded perlite as made up of minute sealed bubbles. (Finding of Fact 5, App. 13) That is one interpretation. The appellee and the Trial Court seem to think that since appellant's data show this cannot be true, the item should be interpreted to mean that it is a filter aid if its structure is completely destroyed and a suitable particle size is selected. Under the authority of the *Baldwin-Southwark* case, *supra,* this alone should be enough to destroy its probative value.

3. The "Suggested" Use of Expanded Perlite for "Filter Aid" in Chem. & Met. Must Have Been Made Inadvertently or Through Ignorance of What a Filter Aid Is and How It Can be Made

There was substantial data in the application in suit showing that an expanded, volcanic glass of cellular structure, whether ground to the size suggested in the Compressed Air article, or unground and of the same or smaller size, is not a filter aid (App. 66-70). They in fact are no better than sand which not even the appellee contends is a filter aid or a source of filter aid. The data presented by Dr. Leppla, appellant's expert, confirmed this. The record further shows that the flow rate is actually less when the cellular perlite is used than when using only the septum (the cloth or the like which supports the particles) (App. 36, 38, 89—Plaintiff's Ex. 10). The Court questioned Dr. Leppla at length on this point:

> "The Court: Dr. Leppla, it says in this article to which counsel has called your attention, 'As a result of experimentation since that time, suggested uses of exploded perlite include,' among other uses 'filter aids.'
>
> "Your answer to that is that exploded perlite could not be a filter aid?

> "The Witness: That is right.
>
> "The Court: I am assuming you have made experimentations, have you?
>
> "The Witness: Yes, sir.
>
> "The Court: Then how do you account for the claim, unequivocal difference of opinion, between what is stated in the article, and what you stated? The article states as a result of experimentation it is found to be a filter aid, and you say categorically it is not.
>
> "The Witness: The technique of filter aids is very special. There are relatively few people who are familiar with the requirements to make a filter aid. It seems to me clear from examining the language of this article, that the gentleman who prepared it, who is anonymous in this reference, was not at all familiar with filter aids. I believe that he was misled into making this suggestion by the fact that exploded perlite is a light weight material, but filter aids are also a light weight material, but their characteristics are entirely different in that filter aids are light weight because of the large space occurring between the particles whereas the exploded perlite, as he explains, with sealed voids contains the void volume within the particle, and is sealed off from any useful purpose as a filter aid.
>
> "The Court: Well, it comes down to this, that you as a chemist do not go along with that statement?
>
> "The Witness: No, I think he made that suggestion through his misunderstanding of filter aids." (App. 19, 20)
>
> * * * * *
>
> "The Court: And the man who wrote it didn't know what he was talking about.
>
> "The Witness: That is right, and he isn't identified here." (App. 21)

Nor could the witness be shaken on cross-examination (App. 44, 45). It is significant that neither the Court nor the appellee attacked the data presented in the application and by the witness, nor the sufficiency thereof to support the testimony. It stands uncontroverted and this Court is not, therefore, bound by Rule 52(a).

It is of little importance whether Dr. Leppla's surmise that the anonymous author used the term in ignorance of what a filter aid is; or whether the term was used inadvertently. It is evident that if the author had left off the word "aid", the suggestion would have been consistent with the disclosure in the Compressed Air article and with the statement in the application (App. 67) that particles of expanded perlite might be used as *filters,* as distinguished from *filter aids.* The important fact that has been established is that cellular perlite is not a filter aid, the use of the word in the article notwithstanding.

This Court stated in *The Mathieson Alkali Works, Inc.* v. *Coe,* 90 F. (2d) 443 at 445, 69 App. D.C. 210:

> "It seems apparent that Trostel's reference to chlorite was ignorantly or inadvertently made. It is entirely unsupported by the unanimous testimony of experts who have been familiar with the art for years. The accidental stumbling onto a fact, or the unintentional statement of a fact, might be considered sufficiently a part of the prior art to require its investigation. [Citing authorities] *But a statement so contradictory to fact, as this was demonstrated to be, is not a part of the prior art.*" (Emphasis Added)

The Chem. & Met. article speaks of the suggested use as being a result of experimentation. Perhaps its author did make a filter aid. Significantly he does not give the results of the experimentation or tell how he made a filter aid, if indeed he made one.

> "The naked assertion that a certain result has been accomplished without stating how, without describing the means which produce the result, is insufficient as an anticipation." *American Graphophone Co.* v. *Leeds & Catlin Co.,* 170 Fed. 327, 331, 95 C.C.A. 511, 515.

Also see *Loew Filter Co.* v. *German-American Filter Co.,* 164 Fed. 855, 90 C.C.A. 637; *Naylor* v. *Alsop Process Co.,* 168 Fed. 911, 94 C.C.A. 315.

This Court in *In re Ek,* 19 F. (2d) 677, at 678, 57 App. D.C. 203, quoted from *Carson* v. *American Smelting & Refining Co.,* (C.C.A.) 4 F. (2d) 463, 465 as follows:

> " ' . . . An American patent is not anticipated by a prior foreign patent, unless the latter exhibits the invention in such full, clear and exact terms as to enable any person skilled in the art to practice it without the necessity of making experiments.' "

Badische Anilin & Soda Fabrik v. *Kalle & Co. et al,* 104 Fed. Rep. 802, at 808, 809, an oft quoted case, said as follows:

> "The 'description in a printed publication' of the statute is to be found within the four corners of such printed publication. Judge Coxe tersely and accurately expresses the law and the reason for it in the following passage:
>
> > 'The question is, what does the prior publication say? not what it might have said, or what it should have said. If prior patents and publications can be reconstructed by extrinsic evidence to fit the exigencies of the case, *the inquiry will no longer be confined to what the publication communicates to the public, but it will be transferred to an endeavor to ascertain what its author intended to communicate.*' " (Emphasis Added)

An isolated sentence from the Chem & Met. item on thermal insulation is coupled with the extrinsic evidence, first of the Compressed Air article on grinding to 40-80 mesh (but doing nothing with the material finer than 80 mesh) (App. 46) and secondly, the Thatcher teaching that diatomaceous earth filter aids are used as fine powders, a fact known since at least 1898. From this the Court concludes that the anonymous Chem. & Met. writer must have intended to communicate the present invention to the public, or at least something so close to it as to obviate patentability. This despite the uncontroverted evidence that even with this interpretation, the expanded perlite of the

Chem. & Met reference cannot be converted into a useful filter aid.

4. "The Law Requires Not Conjecture But Certainty"

That cogent statement was made in *Wisconsin Alumni R. Foundation* v. *George A. Breon & Co.,* 85 F. (2d) 166, 1c. 167.

In *Cold Metal Process Co.* v. *Carnegie-Illinois Steel Corporation et al,* 108 F. (2d) 322 at 332, 333, Cert. Denied 309 U.S. 665, the Court said:

> "In considering the prior art as embodied in the many patents cited to show lack of novelty in Steckel's combination, we here note case of Skelly Oil Co. v. Universal Oil Products Co., 3 Cir., 31 F. 2d 427, 431, where, speaking for this court, Judge Woolley admirably stated the test as follows: 'A patent relied upon as an anticipation must itself speak. Its specification must give in substance the same knowledge and the same directions as the specification of the patent in suit. * * * It is not enough to prove that a method or apparatus described in an earlier specification can be made to produce this or that result. [Citing Authority] A singularly sensible test of the rule of anticipation is given in British Thomson-Houston Co. v. Metropolitan Vickers Electrical Co., 45 R.P.C. 22, by asking the question—'Would a man who was grappling with the problem solved by the patent attacked, and having no knowledge of that patent, if he had had the alleged anticipation in his hand, have said: "That gives me what I wish?"' [Citing Authorities]"

The Supreme Court has said:

> "Knowledge after the event is always easy, and problems once solved present no difficulties, indeed, may be represented as never having had any, and expert witnesses may be brought forward to show that the new thing which seemed to have eluded the search of the world was always ready at hand and easy to be seen by a merely skilful attention. But the law has other tests of the invention than subtle conjectures of what

> might have been seen and yet was not. It regards a change as evidence of novelty, the acceptance and utility of change as a further evidence, even as demonstration."

Diamond Rubber Company of New York v. *Consolidated Rubber Tire Company and Rubber Tire Wheel Company*, 31 Sup. Ct. 444 at 447.

5. The Thatcher Reissue Patent Affords No Guide to the Claimed Process

Diatomaceous earth is the only true filter aid disclosed in the Thatcher reissue patent. Neither expanded perlite nor anything resembling it was mentioned. Other materials such as carbon, charcoal, fuller's earth and decolorizing clays disclosed in the patent are not true filter aids as that term is defined in the present specification (App. 26). Indeed it frequently requires the use of filter aids to remove them from the liquids (App. 28). Thatcher himself (App. 83) differentiates between these materials, which are used to *adsorb* colored impurities from solutions, and the diatomaceous earth filter aids which are used to clarify turbid liquids by mechanical removal of suspended solids. This fully substantiates Dr. Leppla's testimony to the same effect (App. 26-28).

Thus, the Thatcher patent stands as one segment of a well developed field of art beyond the bounds of which no one had been able to step for the nearly half century preceding the present discovery. Yet the appellee and the Court below seem to have had no difficulty in taking this step—after seeing the application in suit. In Finding of Fact No. 3 (App. 12) the Court stated:

> "3. The patent to Thatcher, Reissue No. 19,166, relates to a filter aid in which it is taught to use ground diatomaceous earth filter particles which are graded in size substantially as stated in claim 17."

In Finding No. 7 (App. 13) which really is a conclusion of law, the Court stated:

> "7. It was not a matter of invention to grade the particle sizes to the values specified in claim 17 in suit, in view of the teaching of substantially similar values of particle sizes in the prior art patent to Thatcher for use in a filter aid made from diatomaceous earth particles."

These findings present three points of reversible error. First, Finding 3 is an erroneous fact finding; secondly, Finding 7 is a misapplication of rules of law to an erroneous finding of fact; and thirdly, the findings are taken out of context, disregarding other Thatcher teachings which far from foreshadowing the invention, point up the unexpected, unobvious character of appellant's achievement.

This Court is not bound by either of these findings since they are based upon a document which this Court is in as good a position to evaluate as was the Trial Court.

6. Thatcher's Diatomaceous Earth Filter Particles Are Not "Graded in Size Substantially as Stated in Claim 17"

Claim 17 states that the product contains not more than about 40 percent by weight of particles smaller than 3 microns and not more than 20 per cent by weight of particles larger than 40 microns (mu) in size. Thatcher states, *inter alia* that his product shall contain not more than 50 percent nor less than 15 percent by weight having an average dimension of about 10 microns or larger. There is no way to determine whether Thatcher's products would or need contain more or less than 20 percent of particles larger than 40 microns in size since his specification is silent as to +40 micron particle size. Nor is it inherent that particle distribution meeting Thatcher's teachings would, *ipso facto*, meet the limitation of claim 17, namely, that not more than 20 percent shall be larger than 40 microns. All of Thatcher's +10 micron particles could be larger than 40 microns and still be within the scope of his disclosure and his claims, provided only that they did not amount to more than 50 percent of the composite filter aid. Therefore, there is no basis and can be no justification for concluding that Thatcher's diatomaceous earth particles are "graded substantially as stated in claim 17."

It follows that Finding No. 7 is clearly erroneous since it is based on a false assumption of fact. Accordingly the Court should be reversed.

7. Thatcher, When Taken in Context, Points up the Unexpected Character of Appellant's Accomplishment

Keeping the foregoing in mind it is necessary to inquire as to whether there is any common basis on which particle size distribution can be compared. A limited comparison can be made of the proportion of particles of +10 microns and +6 microns, although this affords no information with respect to the +40 micron limitation of claim 17. For convenience, such a comparison is made between the Thatcher teachings and certain of appellant's examples, in the following Tables.

TABLE 1

Thatcher (App. 84, 85)

diam, mu*	Range	#1	#2	S
+10, Wt. %	15-50	40	28	55
+ 6, Wt. %	42-66	66	42	91
—6, (by diff.)	58-34	34	58	9

TABLE 2

Appellant's Examples (App. 59, 60)

diam, mu*	1	2	3	(a)	4	6	7	8	(b)	11	12	13
+10, Wt. %	53	58	84	55	16	25	40	41	2	3	2	2
+ 6, Wt. %	83	84	99	75	52	70	80	77	—	11	16	20
—6, (by diff.)	17	16	1	25	48	30	20	23	—	89	84	80

(a) Appendix page 56
(b) Appendix page 57
* mu = micron

It will be observed that eleven of the twelve examples of perlite filter aids, which have been demonstrated to be equal or superior to diatomaceous earth filter aids of comparable quality, fall outside Thatcher's limits of 15 percent to 50 percent of 10 microns and larger (which Thatcher states are the essence of his invention) as well as being outside the limitation of 42 percent to 66 percent of 6 microns and larger, contained in a number of his claims.

Of the appellant's examples, the first four are above the critical maximum limits placed on the +6 micron and +10 micron particles of Thatcher. Samples 6 to 8, while falling within the allegedly critical limit as to the +10 micron particles of Thatcher, contain proportions of +6 microns far above the maximum limit of the Thatcher teachings. As to the remaining four perlite filter aids all are far below the critical minimum of 15 percent of +10 micron particles and only one falls within the range of +6 micron specified by Thatcher.

By way of further emphasis of this point, attention is called to the similarity between Thatcher's "useless" sample S and the first four perlite filter aids shown in the above table. The proportion of +10 micron particles, namely 55 percent, is approximately the same as three of the first four perlite filter aid samples. The proportion of +6 microns is intermediate between the highest and lowest values given in the perlite examples. The fourth (Sample 3) has even a higher proportion of the larger particles, and hence by Thatcher's yardstick should be even more useless. With respect to sample S, Thatcher states as follows in column 1, page 3, line 57 (App. 85):

> "The material designated as S having more than 50 percent of 10 microns or larger particles . . . *did not retain any of the impurities present in the liquid being filtered and was, therefore, useless.* These two materials [samples Q and S] do not fall within my particle size limitations and show by comparison the value of my invention." (Emphasis Added)

On the limited basis of comparison available, only one perlite filter aid resembles the particle size distribution Thatcher claims is the essence of his invention. *It* is barely within the minimum limit of 15 percent +10 micron particles. *Four* of the perlite filter aids resemble Thatcher's useless filter aid in particle distribution.

The remaining samples (b) and 11-13, are likewise outside Thatcher's limitations. Such results are new and entirely unpredictable and unobvious. This is the stuff of which inventions are made.

Based upon the incompleteness of Thatcher's teachings; upon the self-evident fact that the same criteria of particle size does not apply to Thatcher's product and perlite filter aids; and upon the unexpected result overlooked by the Trial Court, that Court's inferences and conclusions are without scientific or legal justification. The decision should be reversed.

This Court is not bound by Rule 52(a) since the data are embraced in two unchallenged documents, namely the Thatcher patent and the application in suit. This Court is in as good a position as was the Trial Court to evaluate this evidence.

8. Unobviousness Is Established by the Unexpected Superiority of Filter Aids Made by the Claimed Invention

As a further point establishing the unexpected and unobvious result, a comparison can be made between the performance of Thatcher's product and the filter aids made by the appellant's process.

In the Table on page 3, at line 50 (App. 85), Thatcher gives the rate of flow of a 60° Brix sugar solution as being 4.5 gallons per square foot of filter area per hour when using his filter aid No. 2. Assuming that the liquid would continue to flow at the same rate during a succeeding one-hour period, Thatcher's flow rate would be 9.0 gallons per square foot per two hours.[3] If this flow rate is compared with that of filter aids I and II as shown in column 4 of the chart (App. 90, Plaintiff's Exhibit 11), it will be found that the perlite filter aids made according to the claimed process are nearly *five to six times* that of the Thatcher material. Specifically the perlite filter aid made from two pound per cubic foot expanded perlite (No. I) yielded a flow rate of about 53 gallons per square foot per two hours and filter aid II, made from 3¼ pound expanded perlite, is about 42 gallons, as compared with something less than 9 gallons for the Thatcher material.

Referring to Plaintiff's Exhibit 9 (App. 87) and using the limited basis of comparison available, it will be observed that the proportion of +10 micron particles in these two perlite filter aids are close to the proportion of diatomaceous earth in Thatcher's product No. 2. Sample I contains 28.5 percent of +10 micron particles; Sample II contains 35 percent of +10 micron particles, as compared with 28 percent for Thatcher.

It is thus clearly evident that the perlite filter aids made according to the claimed process are far and above better than the best natural diatomaceous earth filter aid exemplified by Thatcher. Even product III, which is not a useful filter aid (App. 43), has a flow rate of about 22 gallons as compared with less than 9 gallons of Thatcher's best product. This filter aid contains 28 percent of +10 microns which is the same as in the Thatcher product No. 2 (App. 87, Plaintiff's Exhibit 9).[4]

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[3] This assumption gives the Thatcher product every advantage and every benefit of the doubt. The flow rate through a filter actually begins at a high rate and progressively decreases as time goes on so that Thatcher's actual flow over a two-hour period would be something less than 9 gallons per square foot per two hours.

[4] Although the record does not make it clear, the diatomaceous earth filter aids which were used as a basis for comparison of performance of the perlite filter aids made in accordance with this invention and which are described in the application in suit, were not natural filter aids. Most diatomaceous earth filter aids are prepared by mixing them with a flux, i.e. a material which

Thus, judged by present day standards Thatcher's best filter aid is not a useful product, or at best would have but limited utility.

This is further and compelling evidence of a new and unobvious result upon which patentability may be predicated. The decision should be reversed.

In *Switzer et al.* v. *Marzall,* 105 F. Supp. 841, 94 USPQ 368 at 370, the Court said:

> "Sometimes the change in use of accepted materials and the advance in the art is slight, but invention is not measured solely by extent of change in use of accepted materials or the distance of advance from former practices. Inventions are somewhat like precious jewels, whose value is indicated not so much by size as by brilliance. If a mechanical change or routine adjustment produces merely a mechanical or routine result it is not invention, even though it is improvement. But if a change or adjustment produces an extraordinary result, then the change or adjustment takes on something of the character of the accomplishment.
>
> "The defendant says also, 'An unexpected result does not constitute invention'. And that is of course true, an unexpected result does not of itself, or alone, constitute invention. But let us not forget that the Constitution authorized patent laws for the protection of 'discoveries'. If an unexpected result does not constitute invention, it certainly should not disparage an inventor's accomplishment. * * * The extraordinary nature of an accomplishment implies an extraordinary use or application of the ordinary implements and a more profound understanding of the science, art or craft; and if the use or application is original and useful, it is invention. *If the trend*

---

will reduce the sintering point of the diatomaceous earth, and are then calcined. This is done in order to improve the flow rate of the earth to five or more times that of a natural diatomaceous earth filter aid such as Thatcher describes. *Celite Corporation* v. *Dicalite Co.,* 96 F. (2d) 242, at 246 and 247. It is this type of chemically treated and calcined diatomaceous filter aids with which appellant's filter aids were compared.

> *of the teaching of prior art had been against such use for the desired result,* (as in this case—record pages 46 and 47) *then that is additional proof of invention.* A sound public policy supports the provision of the patent law to promote the progress of science by securing to inventors the exclusive right to their 'discoveries.' " (Emphasis Added)

9. Perlite Filter Aids Made by the Process of the Invention Possess Greater Utility and Greater Versatility Than Thatcher's Diatomaceous Earth Product

Filter aids are used to clarify liquids having widely varying characteristics and also having a wide variety of suspended solids or muscilaginous suspensoids differing in ease or difficulty with which they can be removed by filtration. As the specification of the application points out (App. 58) several grades of filter aid are required to meet the demands of industry. In the application (on pages 59 to 66 of the Appendix) are described in detail three different types of product, namely, those having a high flow rate, a medium flow rate and a low flow rate, each of which is useful and the selection of which is based upon the degree of clarification desired, the ease or difficulty with which the suspensoids can be removed, and the character of the liquid undergoing filtration.

A mere examination of the data presented in the Thatcher reissue patent shows that his diatomaceous earth filter aid is of limited utility and that its characteristics are such that it would yield only a low flow rate product. It is evident from comparison of Thatcher's product No. 2 and his useless sample S that a very small change in particle distribution so as to produce even a relatively small increase in flow, results in the useless product. Even useless sample S which has a little over twice the flow rate of Thatcher's product No. 2 yields a flow rate far below that of the filter aids made according to the present invention. The enormously greater utility and versatility of filter aids made according to the claimed invention are further evidence of an unexpected and unobvious result. If Thatcher points in any direction relevant to the issues here, it is in another direction. This too should serve as a ground for reversing the lower Court's decision.

D. THE SHAPE AND PHYSICAL CHARACTERISTICS OF DIATOMACEOUS EARTH PARTICLES AFFORD NO CLUE TO THE FACT THAT THE PRODUCT OF THIS INVENTION WOULD BE A FILTER AID

Even a casual comparison of the photomicrographs Plaintiff's Exhibits 3(a), (b) or (c) with Plaintiff's Exhibit 7 and 3(d), (e) and (f) show that the glassy perlite filter aid particles bear no resemblance to diatoms or to expanded perlite. The former are transparent, extremely thin bits of glass. The extreme thinness is well illustrated in the photomicrographs by those particles on which the concentric rings appear. These are actually colored and are known as interference bands or colors. They are similar to the familiar rainbow colored bands one sees in a film of oil on a wet pavement. The transparency and thinness is also strikingly apparent, for example, in Exhibit 3(b). A group of particles resting upon one another just above the center of the picture are so thin that the shape of the particles beneath can be seen through the ones on top.

On the other hand the diatoms are siliceous fossil skeletons of microscopic plants or algae (App. 29, 30). Each species has a characteristic structure as one might expect of the skeleton of a formerly living creature.

Reference to Plaintiff's Exhibits 3(d), (e) and (f) establish the multicellular structure and generally spherical shape of expanded volcanic glass such as perlite of the references. Exhibit 3(d) is 40-80 mesh perlite as produced. Exhibit 3(e) is expanded perlite ground to 40-80 mesh. Exhibit 3(f) is expanded volcanic ash, a material much like perlite except for its physical form as it occurs in nature. The particle size is less than 100 mesh (149 microns).

The photographs of the filter aids show that the cellular structure has been completely destroyed.

It is apparent on the other hand from Exhibit 7 that the diatomites are either totally unchanged or have been merely broken in two without changing the essential characteristic structure of the diatoms.

Diatomaceous earth is essentially silica. Expanded perlite is glass. There is nothing from the known characteristics of diatomaceous filter aids which would lead one to believe that expanded perlite, which is not a filter aid, could be converted into a filter aid by destroying its physical structure in accordance with the process of the claim. No other inorganic materials were known or are known for that matter, which can be converted into a filter aid by grinding or any other process (App. 25, 27).

E. THE EVIDENCE DEMONSTRATES THE CRITICALITY OF THE 1 TO 6 POUND PER CUBIC FOOT LIMITATION IN THE CLAIM

Data were presented (App. 90) which graphically and strikingly demonstrates the fact that the limitation as to apparent density of the expanded perlite used as a starting material in this process is critical. Three liquids encountered in commercial operations were filtered with perlite filter aids. These were made in accordance with the claimed process to substantially identical particle size distribution, from expanded perlite having bulk densities of 2 pounds, 3¼ pounds and 8 pounds per cubic foot. (These are designated I, II and III, respectively.) In every instance the material made from the 8 pound per cubic foot aggregate was strikingly inferior to the filter aids made from aggregates falling within the claimed limits, as can be seen at a glance.

On the right hand side of the chart (App. 90) the data was translated into terms expressing the commercial significance of the differences between the materials. In the box at the upper right is shown the filter area needed to filter 1000 gallons per hour of sugar solution with each of the three products. This shows, when using the product of a 2 pound per cubic foot aggregate, 38.6 square feet of filter area would be needed, while with the 8 pound aggregate, 94 square feet would be required. This means that for each 1000 gallons per hour of sugar solution to be filtered, the refiner would need over 2.4 times the filter capacity when using the product of the 8 pound expanded perlite than he would need when using the filter aid made from the 2 pound aggregate. This data is graphically expressed in the chart immediately below the box. From this can be determined the filtration capacity of a filter having a given number of square feet of filter area, when using the various materials.

Dr. Leppla testified that filtration equipment is very expensive (App. 43). This means that the refiner having a given plant capacity would have to more than double the capital outlay for equipment. It means that he would have to have additional floor space. He would have to provide additional personnel for the maintenance and operation of the filtration units. In certain types of widely used filter units, the filter aid accumulates in cells between filter plates until they are full. The unit is then taken apart and the spent agent removed, after which it is reassembled and the operation proceeds. Such a filtration unit would have to be shut down and cleaned more than twice as often when using the material from the 8 pound rather than the 2 pound aggregate. Since this is a time-consuming operation, it means that the overall capacity of the filtration equipment would be materially less than the figure presented in the chart reflects, since these are indicative of capacity during actual operation only. They do not reflect directly what the capacity would be if the shut-down periods for removal of the spent filter aid were taken into consideration. Considering this aspect, a more realistic estimate as to the increased filtration equipment requirement when using the product of the 8 pound expanded perlite is of the order of 3 or more. Needless to say, the equipment and personnel for clean outs alone would increase correspondingly.

The values on the chart also were interpreted by Dr. Leppla in terms of the comparative cost of the products made according to this invention and those made of heavier perlite aggregate (App. 42, 43). It is apparent that at least 2.4 times as much filter aid would be required if made from the 8 pound aggregate than if made from the 2 pound aggregate. This means that the filter aid costs, even if they could be sold at the same price per ton, would be increased by a factor of 2.4.

However, the cost of material made from the 8 pound aggregate would be much higher. In Plaintiff's Exhibit 9 (App. 87) it is shown that the yield of material which can be obtained from the 8 pound aggregate is less than half that which can be obtained from the 2 pound aggregate. This means that more than twice as much ore must be mined and prepared for the expanding operation. Expanding and grinding equipment of at least twice the capacity must be maintained and operated. Additional personnel for the mining, beneficiating, expanding and grinding operations must be employed. Even at that, more than half of the expanded perlite produced must be discarded as completely useless. It is obvious, therefore, that the product made from the 8 pound aggregate would cost at least several times that of the product made according to the claimed invention.

These data show that Dr. Leppla was fully justified in testifying to the effect that the material from the 8 pound aggregate is not a useful filter aid. Incidentally, it might be well to interject that the Thatcher diatomaceous earth filter aid No. 2 would require at least 5 or 6 times the filter capacity required when using the filter aid made according to this invention.

F. THE EXPANDED PERLITE OF THE PRIOR ART DOES NOT PRODUCE A USEFUL FILTER AID EVEN THOUGH OF IDENTICAL PARTICLE DISTRIBUTION AS THE PRODUCTS MADE BY THIS INVENTION

The bulk density of the expanded perlite of the prior art can be calculated from the data appearing in them.

Dr. Leppla testified that unexpanded perlite ore has a bulk density of about 75 pounds per cubic foot when prepared ready to be popped (App. 24, 25). The product of the Compressed Air article was said to be expanded to 6½ or 7 times its original volume. By a simple mathematical calculation, the bulk density of resultant expanded perlite would be 11 to 12½ (actually 11.5) pounds per cubic foot, about twice as heavy as the maximum density aggregate which can be used in the claimed process to produce a filter aid.

The Chem. & Met. article states an expansion of 6 to 10 times the volume of the starting material, which corresponds to a bulk density of about 7½ to about 12½ pounds per cubic foot. This is well outside the critical range set forth in the claim. The 8 pound bulk density expanded perlite used to produce product III of Plaintiff's Exhibit 11 (App. 90). is at the lower end of the range of densities disclosed in Chem. & Met.

G. IT IS THE SHAPE OF THE PARTICLES AND ABILITY TO FORM FILTER CAKES OF LOW DENSITY WHICH DETERMINES THE USEFULNESS OF A FILTER AID

The appellee has consistently emphasized particle size as the important factor in determining whether a material would produce a suitable filter aid. This is not true. The important factor is particle shape.

On pages 28 and 29 of the Appendix, Dr. Leppla testified as follows:

> "Q. What would you say are the two principal characteristics requisite of the material to produce an effective filter aid?

> "A. *By far the most important characteristic is the shape of the individual particles.* It is necessary in a filter aid to have particles of very irregular shape, so that when they are packed together in filter cakes, the resulting cake is very open and porous, and a good filter aid will form a cake that is about 85 to 90 percent open, vacant space, whereas most solid materials, in fact almost everything except diatomaceous earth and perlite, form a much denser cake where the void volume may be 25 or 30 percent. (Emphasis Added)

* * * * *

> "The Court: . . . That is the reason I asked Dr. Leppla the question, How critical is the difference in shape? That is why I asked that question.
>
> "The Witness: That is the whole thing. (App. 32)

* * * * *

> "The Court: In other words, Doctor, is it by virtue of the variegated shapes and the total aggregate of the cake, so to speak, plus the tremendous amount of air space that gives the filter aid its utility?
>
> "The Witness: That is right. (App. 33)

* * * * *

> "The Court: And it is by use of the processes set forth in 17 that results in the fineness of utility, so to speak?
>
> "The Witness: Yes." (App. 33)

H. THE EXPANDED PERLITE OF THE PRIOR ART DOES NOT PRODUCE A PARTICLE SHAPE VITAL TO A USEFUL FILTER AID

Dr. Leppla then presented Plaintiff's Exhibit 8 (App. 87) which shows the filter cake density of materials made from expanded perlite having bulk densities ranging from 3.3 to 14 pounds per cubic foot (App. 87). Dr. Leppla explained what was meant by filter cake density and defined the useful range as follows: (App. 35)

> "A. The way we measure that in the laboratory is to take a given weight of filter aid and suspend it in water, stir it up and pour it through a filter, and then we measure after filtration is completed, the volume

occupied by that cake, and divide the volume by the weight and we have the pounds per cubic foot.

"Q. Then from this table, what would you say with respect to the criticality of the upper limit of 6 pounds per cubic foot in the starting aggregate called for by the claim in suit?

"A. These data indicate a material having, an expanded perlite having a bulk density of above 6 pounds per cubic foot, cannot be converted into a filter aid having a cake density in the useful range.

"The Court: Then what is the [maximum] density of the useful range, around about 22 to 24?

"The Witness: It would be about that, yes."

It is significant to note that the appellee did not see fit to cross examine Dr. Leppla or in any other way challenge these conclusions. The evidence, therefore, stands uncontroverted that the maximum bulk density of expanded perlite useful in the claimed process is 6 pounds per cubic foot.

It follows conclusively that the expanded perlite of the prior art and with particular reference to the Chem. & Met. article, does not produce a useful filter aid even though ground to an acceptable particle size. *This can only mean that the expanded perlite of the prior art does not have, nor is it capable of yielding, the requisite shape and physical characteristics to constitute a good filter aid.*

Based upon this evidence which the Trial Court did not see fit to comment upon, one can only conclude that the appellant has achieved still another unexpected and unobvious result to add to the growing list heretofore brought to this Court's attention.

Even if one were to accept the erroneous assumption that the Trial Court must have acted upon, namely, that it would be obvious to a person of ordinary skill in the art, that the expanded perlite of the prior art should be ground to a particle size as defined by Thatcher—even if that interpretation of the Chem. & Met. article were true, which it is not, the present process represents a patentable discovery and the Trial Court's decision should be reversed.

I. THIS IS NOT A MERE SUBSTITUTION OF EQUIVALENT MATERIALS

While the Trial Court wrote no opinion and hence one can only speculate as to its reasoning, it is possible that it considered in making Finding No. 7 that all the appellant had done was to substitute another and equivalent material for diatomaceous earth. If that were its reasoning, the landmark case of *Low et al* v. *McMaster,* 226 F. 518, 1c. 519-520, is in point:

> "On this subject it is the law, that merely to substitute superior for inferior materials, in making one or more or all of the parts of a machine or manufacture, is not invention, although the substitution may be of materials that are both new and useful in high degree. It is also the law, as exceptions to this general rule, that if the substitution involved a new mode of construction; or if it developed new properties and uses of the article made, or where it produces a new mode of operation, or results in a new function; or when it is the first practical success in the art in which the substitution is made; or where the practice shows its superiority to consist not only in greater cheapness and greater utility, but also in more efficient action, it may amount to invention. Smith v. Goodyear Dental Vulcanite Co., 93 U.S. 486, 496, 23 L. Ed. 952; Celluloid Mfg. Co. v. Crane Chemical Co. (C.C.) 36 Fed. 110; Potts v. Craeger, 155 U.S. 597, 608, 15 Sup. Ct. 194, 39 L. Ed. 275; Walker on Patents, §§ 28, 29, 36."

In *Gasoline Products Co., Inc.* v. *Coe,* 87 F. (2d) 550, 1c. 557, 66 App. D.C. 333 which quotes *Low* v. *McMaster, supra,* this Court said:

> "We think therefore that even within the defendant's view of what the art taught broadly, the undisputed evidence in the case concerning the advantages obtained by using chromium alloy tubes in the oil

> cracking process entitles the applicant to a patent. He clearly accomplished at least 'an increase of efficiency' and 'a decided saving in the operation' within the language of Hicks v. Kelsey. Within the words of Low v. McMaster: his machine has acquired 'new properties and uses'; his 'is the first practical success in the art in which the substitution is made'; and 'the practice shows its superiority to consist not only in greater cheapness and in greater utility, but also in more efficient action, . . .' "

In *Wach* v. *Coe,* 77 F. (2d) 113, 1c. 115, 64 App. D.C. 235, this Court said:

> "Many times has it been said that the object of the patent law is the benefit to the public. To that end section 4886, R. S. (35 USCA § 31) [now 35 USC 101] expressly provides that the invention or discovery must be 'new and useful.' Evidence of great utility of a device may in some circumstances be accepted as evidence of invention."

Also see *Carbide & Carbon Chemicals Corporation et al* v. *Coe,* 102 F. (2d) 236, at 240-241, 69 App. D.C. 372.

Again in *Becket* v. *Coe, supra,* this Court said:

> ". . . It seems clear that one seeking to find an alloy both stainless and deep-drawing would be led by the Commentry patent, if at all, into lengthy experimentation. * * * '. . . The nature and character of the invention of 376,837 were, in the record heretofore before this court, put to rigorous tests by examination and cross-examination in court; *and the result which was then reached is not shaken by merely a single sentence in the English patent.'* * * * With the Becket application before us it is possible to look back upon the Hadfield (French) and Commentry (French) patents and to say that they suggested what he found, but such hindsight should not, we think, defeat his application. * * * There is evidence that the proportions named by Becket are critical; in other words, *that substantial departure from his proportions will result in failure to achieve the alloy of his*

invention. The Patent Office does not dispute the utility of the alloy and, as stated above, we are of the opinion that the Hadfield (French) and Commentry (French) patents do not anticipate Becket. The decision of the trial court is, therefore, reversed. . . ." (Emphasis Added)

In *Lucke et al* v. *Coe*, 69 F. (2d) 379, 1c. 383, 63 App. D.C. 61 this Court said:

> "It is comparatively easy, now that the Lucke device is in evidence, to take this and that from the references and achieve a nunc pro tunc solution of the problems confronting Lucke when he made his invention."

CONCLUSION

The positive tests of unobviousness having been established, the decision of the Trial Court should be reversed, and the Commissioner of Patents should be directed to issue a patent on claim 17 of the application in suit.

Respectfully submitted,

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BRIEF FOR APPELLEE

IN THE

United States Court of Appeals For the District of Columbia Circuit

United States Court of Appeals
For the
District of Columbia Circuit
FILED MAR 4 1957
Joseph W. Stewart
CLERK

Appeal No. 13,624

GREAT LAKES CARBON CORPORATION, *Appellant*

v.

ROBERT C. WATSON, COMMISSIONER OF PATENTS,
Appellee

Appeal From the United States District Court for the District of Columbia

BRIEF FOR THE COMMISSIONER OF PATENTS

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Appeal No. 13,624

STATEMENT OF QUESTION PRESENTED

In the opinion of the appellee, the single question presented for determination on this appeal is:

Was it error for the District Court to find that it was not invention to process a newly discovered material, suggested for use as filter aid, by a method known in the art for processing an old material for use as filter aid?

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Statute:

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---

BRIEF FOR THE COMMISSIONER OF PATENTS

INTRODUCTION

This is an appeal by Great Lakes Carbon Corporation from the judgment (Jt. App. 14) of the United States District Court for the District of Columbia dismissing the complaint in an action brought under 35 U.S.C. (1952) 145. In such action, appellant sought to have the District Court authorize the Commissioner of Patents to issue a patent, including claim 17, on application for patent, Serial No. 241,398, filed August 11, 1951, by John W. Kenney, Jr., and Armand R. Bollaert, and assigned to appellant.

The Patent Office examiner, the Board of Appeals, and the District Court have all held claim 17, in suit, to be unpatentable.

THE APPLICATION

The application in suit discloses a process for making filter aids from artificially expanded perlite. Expanded perlite having a bulk density between about one and six pounds per cubic foot is comminuted or ground into a fragmental product. The product is graded as to particle size, and a filter aid is made from particles of the size specified in claim 17.

THE CLAIM

The single claim sought by appellant reads as follows:

> 17. A process for producing a filter-aid from artificially expanded, low bulk density, multicellular perlite aggregate which comprises comminuting perlite aggregate having a bulk density between about one and about six pounds per cubic foot to produce a fragmental product whose particles are substantially less than 149 microns in size and which contains not more than about 40% by weight of particles smaller than three microns and not more than 20% by weight of particles larger than forty microns in size, the milled product further having the property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids.

THE REFERENCES

The prior art relied on by the three tribunals below in reaching their common conclusion that claim 17 is unpatentable, includes:

An article (Jt. App. 79) appearing in Compressed Air Magazine, Vol. 47, page 6694 (1942); an article (Jt. App. 81, 82) appearing in the magazine Chemical & Metallurgical Engineering, Vol. 52, pages 140 and 142 (July 1945); and United States Reissue Patent No. 19,166 to Thatcher, reissued May 15, 1934 (Jt. App. 83 to 86).

The article in Compressed Air Magazine (Jt. App. 79) mentions the discovery that perlite, when heated, may be made to explode like popcorn and form a light mass having a porous structure with the pores well sealed. In describing uses of the exploded perlite, the article includes the statement (Jt. App. 79, third column) "* * * When ground to 40-80 mesh it is suitable for filtering water * * *".

The article in Chemical & Metallurgical Engineering (Jt. App. 81, 82) discusses the making of exploded perlite by heating and states (Jt. App. 81, third column, fourth paragraph):

> "* * * The result of this 'explosion' is that the siliceous material almost instantly solidifies around minute air and moisture bubbles thus sealing them to give a light material having 6-10 times the volume of the original rock and weighing anywhere from just a few pounds up to 10 lb. per cu. ft., depending upon the method and temperature of explosion."

The same article also refers to the exploded perlite as "expanded perlite" (*ibid.,* final paragraph) and specifies uses thereof. Included is the statement (Jt.

App. 82), "* * * suggested uses of exploded perlite include * * *, filter aid, * * *."

The patent to Thatcher, Re. 19,166 (Jt. App. 84, lines 1 to 17; Jt. App. 85, lines 65 to 95) teaches that materials adapted for manufacture of filter aids should be ground or disintegrated and then sorted as to particle size to increase the effectiveness of the filter aid. The patent states (Jt. App. 84, lines 18 to 32):

> "I have found that when inorganic solid materials adapted for manufacture of filter aids, such as diatomaceous earth * * *, are so disintegrated or crushed that not more than 10% of the disintegrated product is left on a 150 mesh screen, not more than 50% or less than 15% of the material, by weight, is composed of particles having an average dimension of about 10 microns (0.01 mm.) or larger and contain not more than 25% by weight of particles smaller than 1 micron (0.001 mm.) in mean dimension, or diameter, such filter aids will show a high rate of flow and at the same time give good clarification."

The patent sets out specific examples of filter aids made from diatomaceous earth.

In Finding of Fact No. 3, the District Court stated, as to the patent (Jt. App. 12):

> "3. The patent to Thatcher, Reissue No. 19,166, relates to a filter aid in which it is taught to use ground diatomaceous earth filter particles which are graded in size substantially as stated in claim 17."

In their decision, the Board of Appeals (R. 75, first paragraph, last sentence) said with reference to the applicants for patent "Appellants admit that the particles size distributions in the Thatcher material is similar to that in their perlitic filter aid."

SUMMARY OF ARGUMENT

1. Questions of patentability and invention are questions of fact and a reasonable finding that claims lack invention should not be set aside.

2. After expanded perlite became known, in 1941, magazine articles appeared, in 1942 and 1945, discussing the characteristics of the new material and suggesting uses which might be made of it. The suggested uses included filtering water, and as a filter aid. The patent to Thatcher had already taught the filtration art a method of processing "materials adapted for manufacture of filter aids." Application of this known process to the preparation of expanded perlite as a filter aid should have been obvious to the person skilled in the art.

3. Included in the expanded perlite to be processed by the Thatcher method, as a result of the suggestion in the articles, would be expanded perlite having a bulk density between one to six pounds per cubic foot mentioned in claim 17 on appeal.

4. Processing the expanded perlite in the manner taught by Thatcher includes grading the particle sizes substantially as recited in claim 17.

5. Nothing further in claim 17 defines any advance over the prior art that rises to the dignity of invention.

6. Appellant's arguments for patentability (Brief, pages 33 to 38) are based on the erroneous supposition that the art did not suggest the use as a filter aid of any expanded perlite of a density less than six pounds per cubic foot.

ARGUMENT

1. This Court has specifically held that the question of invention is a question of fact. *Minnesota Mining and Manufacturing Co.* v. *Coe,* 73 App. D. C. 146, 118 F. 2d 593, certiorari denied, 314 U. S. 624, rehearing denied, 315 U. S. 826. Also, in *Besser* v. *Ooms,* 81 U. S. App. D. C. 7, 154 F. 2d 17, this Court, with a lavish citation of authorities, said:

> "Since invention is a question of fact, a reasonable finding that claims lack invention should not be set aside."

Furthermore, in its decision in *Standard Oil Development Co.* v. *Marzall,* 86 U. S. App. D. C. 210, 181 F. 2d 280, this Court pointed out that the question of patentability decided by the trial court "must be resolved by a subjective opinion as to what seems an easy step and what does not," but stated:

> "* * * Where the decision involves such a subjective opinion a somewhat wider latitude properly may be exercised by a reviewing court. This larger freedom *must yet remain within the bounds established by the rule that findings of fact of the trial court are not to be set aside unless clearly erroneous* * * *" (Emphasis added).

In two recent decisions by other Circuit Courts of Appeal, findings on questions of invention have been held to be subject to the provisions of Rule 52(a) of the Federal Rules of Civil Procedure. *University of Illinois Foundation* v. *Block Drug Co. et al.* (C.A., 7th, 1957), 112 USPQ 204, F. 2d , and *Hall et al.* v. *Wright et al.* (C.A., 9th, 1957), 112 USPQ 210, F. 2d .

Accordingly, it is submitted that findings as to invention here made by the District Court, repeating findings made in the Patent Office, are subject to the provisions of Rule 52(a) and should not be set aside unless clearly erroneous. Presumably, appellant centers its attack (Brief, pages 12 and 13) on Findings of Fact Nos. 6 to 10. There should be no doubt that the other findings of fact, Nos. 1 to 5 (Jt. App. 12, 13), are subject to the provisions of Rule 52(a) of the Federal Rules of Civil Procedure.

2. Expanded perlite apparently became known about 1941 (Jt. App. 31 and 82). In 1942, an article in Compressed Air Magazine (Jt. App. 79) described the material and stated, "When ground to 40-80 mesh it is suitable for filtering water." Then, in 1945, an article in Chemical & Metallurgical Engineering (Jt. App. 81, 82) discussed the material—describing how it was made and some of its qualities. The latter article ascribed uses to the material and included was a use as "filter aid". That article did not mention any process for preparing the material for its use as a filter aid.

According to appellant's witness (Jt. App. 25, 26, 28), no inorganic material, other than diatomaceous earth, was known as a useful filter aid material as of the time of the articles. Interest hence expectedly would be sharp in a new inorganic material suggested for use in filtering water and as filter aid. The person skilled in the filtration art could hardly be expected to ignore the specific suggestion in the Chemical & Metallurgical Engineering article.

This article does not describe any process for preparing the expanded perlite for use as filter aid. However, in the patent to Thatcher the art is taught a method of processing "materials adapted for manufacture of filter aids" (Jt. App. 84, lines 18 and 19). While the method there is applied to diatomaceous earth, it should have been obvious to the person skilled in the art to apply the Thatcher process to the new material.

Appellant asserts (Brief, pages 15 and 19) that the suggested use of expanded perlite for filter aid in the article in Chemical & Metallurgical Engineering "could only have been made inadvertently or in ignorance of what a filter aid is," and thus that the publication was in error in making the suggestion. The burden of appellant's objection to the article appears to be that it indicates, and would indicate to the person skilled in the art, only that expanded perlite may be used as filter aid without any further processing. Presumably, the reader of the article is not supposed to turn his thoughts toward using known processes in preparing the new material for its suggested use.

The testimony (Jt. App. 19 and 20) of appellant's witness is, of course, to the effect that the suggestion in the article, when read as appellant reads it, was in error. However, his testimony hardly answers the question of what he would have done had he read the article when it was published, and had been interested in the making of filter aids, and had known of the teaching in Thatcher.

Appellant has cited (Brief, page 21) *The Mathieson Alkali Works, Inc.* v. *Coe,* 90 F. 2d 443, 69 App. D. C. 210. There a statement in a reference patent, that "as ordinarily practiced" chlorite was used in bleaching paper pulp, was found by this Court to be untrue. There the statement was undoubtedly untrue. In the case at bar appellant has made no like frontal attack on the statement in the Chemical & Metallurgical article that "As a result of experimentation * * *, suggested uses of exploded perlite include * * * filter aid * * *." (Jt. App. 82.) The question posed here is what the person skilled in the art might be led to do or think from reading the statement. In the portion of the decision quoted by appellant (Brief, page 21) the sentence, "The accidental stumbling onto a fact, or the unintentional statement of a fact, might be considered sufficiently a part of the prior art to require its investigation," is more applicable to this case than the italicized part of the quotation, although even it does not fit the facts here. A precedent more in point than any cited by appellant is *In re Aller et al.,* 42 CCPA 824, 830, 220 F. 2d 454, 458. In that case, the Court of Customs and Patent Appeals stated:

> "Appellants suggest that the decision to experiment with the process in the first place involves invention, apparently on the theory that the process as disclosed by Hock and Lang appears so impractical that no skilled chemist would have experimented with it. References have always been valid for what they would convey, explicitly or implicitly, to one skilled in the art. That experimentation may not have appeared promising is of no importance. * * *"

3. The article in Chemical & Metallurgical Engineering directly suggests the use of expanded perlite as filter aid. This article in describing the making of expanded perlite and its physical properties states (Jt. App. 81, column 3):

> "* * * The result of this 'explosion' is that the siliceous material almost instantly solidifies around minute air and moisture bubbles, thus sealing

> them to give a light material 6-10 times the volume of the original rock and weighing anywhere from just a few pounds up to 10 lb. per cu. ft., depending upon the method and temperature of explosion."

Appellant argues (Brief, page 12, paragraph numbered 7; page 36) that the article does not disclose expanded perlite having a bulk density within the range of 1 to 6 pounds per cubic foot mentioned in the claim on appeal. The statement is made (Brief, page 36):

> "The Chem. & Met. article states an expansion of 6 to 10 times the volume of the starting material, which corresponds to a bulk density of about 7½ to 12½ pounds per cubic foot. This is well outside the critical range set forth in the claim."

The values, "7½ to 12½ pounds per cubic foot," so referred to by appellant, are from a calculation made by appellant's witness (Jt. App. 24, 25). The witness noted that the article indicates that the light material resulting from the "explosion" has "6-10 times the volume of the original rock" and he assumed a bulk density of 75 pounds per cubic foot for perlite ore. However, there is no need to speculate on the density of the original rock and to make the calculation. In the same sentence in the article mentioning "6-10 times the volume of the original rock" is a direct statement as to the bulk density of the expanded perlite: "weighing anywhere from just a few pounds up to 10 lb. per cu. ft." Appellant's witness on cross-examination recognized the presence of the direct statement (Jt. App. 45).

The article, then, suggests the use of expanded perlite of the densities recited in the claim on appeal and it would be obvious for the person skilled in the art to use material falling within the range recited in the claim. Certainly he could not be expected to restrict himself to a limited and inoperative portion of the suggested range of densities. Pertinent here is the decision of the Court of Customs and Patent Appeals in *In re Jones,* 28 CCPA 1302, 1306, 120 F. 2d 1019, 1021. In that case, that Court said:

> "Appellant contends there are so many materials to be used as viscosity reduction agents set out in the reference that the disclosure amounts to little more than a prophetic suggestion and is merely an invitation to carry on research. Appellant has also submitted affidavits showing the results of experiments indicating that some of the materials set out in the reference do not, when added to the mud, benefit the filtration rate of the mud. We agree with the tribunals of the Patent Office that even if a publication contains the disclosure of several materials which do not anticipate those shown in the claimed invention, this, of itself, is not sufficient to vitiate its effect as a reference when it also discloses the same materials as the application."

The District Court, it is submitted, properly found as a fact (Finding of Fact No. 6, Jt. App. 13) that "It was not a matter of invention, in view of the prior art, to make filter aid from expanded perlite by grinding or comminuting starting material having a density of from one to six pounds per cubic foot."

4. Appellant contends (Brief, pages 25 and 26) that the patent to Thatcher does not teach the use of diatomaceous earth filter particles which are graded as stated in claim 17 on appeal and that Finding of Fact No. 3 is in error. He also contends that Finding of

Fact No. 7 is in error because based on Finding No. 3.

Appellant's argument apparently is that Thatcher may have more than 20% of the particles in the filter aid larger than 40 microns, whereas the claim calls for "not more than 20% by weight of particles larger than forty microns in size." However, in the patent (Jt. App. 84, lines 25 to 28) the plain statement is made that "not more than 50% or less than 15% of the material, by weight, is composed of particles having an average dimension of about 10 microns (0.01 mm.) or larger." If the lower 15% value or even a 20% value (from within the 50% to 15% range) is considered, there could not possibly be any more than 20% of the particles larger than 40 microns. Moreover, Thatcher's product No. 2 (Jt. App. 85, lines 12 to 31 and lines 45 to 50) shows only 28% of particles larger than 10 microns and it is not likely there would be any amount substantially greater than 20% of the particles over 40 microns in size.

As has already been indicated, the applicants for patent admitted before the Board of Appeals (Jt. App. 75, first paragraph, final sentence) that "the particle size distributions in the Thatcher material is similar in size to that in their perlitic filter aid."

Neither of Findings of Fact Nos. 3 and 7, it is submitted, is erroneous.

It is beside the point for appellant to argue (Brief, pages 26 to 28) that the applicants have found some useful mixtures wherein the percentages of larger particles are outside the range taught by Thatcher. Claim 17, on appeal, is not restricted to the employment of mixtures outside Thatcher's suggested range. There is no need, accordingly, to determine whether their employment would involve invention. It is generally possible, of course, to draw a broad claim to cover both the prior art and something not shown in the prior art and claim 17 is such a broad claim.

Appellant's comparisons (Brief, pages 28 to 30) as to flow rates lack significance. In the first place, it is not known what pressure was used in the flow test of Thatcher and so it is not clear that the comparisons are accurate. Also, it is difficult to compare the amount of fine material in Thatcher's product No. 2 (Jt. App. 85) with that in appellant's Samples I and II, Exhibit No. 9 (Jt. App. 87). Thatcher separates his groups at 2, 4 and 6 microns whereas appellant separates the groups at 3 and 5 microns. However, it may be noted that Thatcher in his product No. 2 (Jt. App. 85, lines 16-28) has 28% of his particles at 2 microns or below and 20% between 2 and 4 microns. Interpolation would give 38% at 3 microns or below, whereas appellant's Sample I has only 13% below 3 microns. Thatcher discloses (Jt. App. 84, lines 48 to 58) that a greater amount of fine particles decreases the flow rate. The alleged differences appellant finds hence would not be unexpected.

Here again, the claim is broad enough to cover the prior art as well as what applicants have done.

5. The claim recites that the milled expanded perlite shall have the "property of subsiding substantially completely in water and being substantially free of sealed or partially sealed voids."

Obviously a filter aid that floats would be of no value. Furthermore, the method of grading particles followed by Thatcher (Jt. App. 84, line 141 to Jt. App. 85, line 11) depends upon the particles sinking in water. Therefore, a filter aid processed as taught by Thatcher would be expected to sink in water.

The breaking up of the sealed voids would appear to be an inherent and expected result of grinding to the very fine sizes required, both in Thatcher's and applicant's processes. No evidence has been adduced to show that expanded perlite having a density of a few to 6 pounds per cubic foot processed as taught by Thatcher would not be substantially free of sealed voids. Appellant's argument (Brief, page 32) is based on comparisons with a 40-80 mesh (420-177 microns, Jt. App. 67) product, which is not the range taught by Thatcher.

There is, therefore, nothing in claim 17 which defines any advance over the prior art that rises to the dignity of invention. Findings of Fact Nos. 8 to 10 are correct.

6. Appellant's further arguments (Brief, pages 33 to 38) are based on the supposition that the person skilled in the art would be restricted to the use of expanded perlite of a bulk density above 6 pounds per cubic foot. As pointed out hereinabove, the article in Chemical & Metallurgical Engineering suggests the use of expanded perlite of less than 6 pounds per cubic foot density. Finding of Fact No. 6 indicates that it is not invention to use starting material having a density of 1 to 6 pounds per cubic foot.

CONCLUSION

It is respectfully submitted that the decision of the District Court, denying appellant a patent, is correct and should be affirmed.

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REPLY BRIEF FOR APPELLANT

IN THE

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

United States Court of Appeals
For the
District of Columbia Circuit

FILED MAY 1 1957

Joseph W. Stewart
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No. 13,624

GREAT LAKES CARBON CORPORATION, *Appellant*

v.

ROBERT C. WATSON, COMMISSIONER OF PATENTS, *Appellee*

Appeal from the United States District Court for the District of Columbia

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PRESS OF BYRON S. ADAMS, WASHINGTON, D. C.

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REPLY BRIEF FOR APPELLANT

THE APPELLEE OVERSIMPLIFIES THE STATEMENT OF THE QUESTION PRESENTED AND HENCE IT IS MISLEADING

The question to be decided is correctly stated in appellant's brief.

If the Appellee's statement of the question were amended as shown in italics below, it would more nearly present the question in its true light, although even this is too broad.

> Was it error for the District Court to find that it was not invention to process a [newly discovered] material *erroneously* suggested for use *in unchanged physical form* as a filter aid, by a *superficially similar* method known in the art for processing an old *natural filter aid* material *of entirely dissimilar physical characteristics and origin,* for use as filter aid, *despite the fact that the* [newly discovered] *material cannot be converted to a useful filter aid by Thatcher's or any other known process.*

THE ULTIMATE QUESTION OF PATENTABILITY IS ONE OF LAW

In Deller's Edition of "Walker on Patents" Sec. 35, p. 115 (1937) it is flatly stated: "The question of invention is a question of fact and not of law".

In the 1955 cumulative supplement the same section states:

> "It is generally said that the determination of patentable invention is a question of fact. The ultimate question of patentability, however, is one of law." (Also see Brief 12-13)

He further points out this change of view can be explained by breaking down the question of patentable invention into component parts: (1) what the prior art was; (2) what the patentee did to improve upon it (both of these are fact questions); and (3) whether this amounted to invention.

The realistic view, therefore, is that the deciding of the presence or absence of patentability involves applying rules of law to the evidence and determining whether a patentable discovery has been made as a matter of law. In the early days when there were few rules of law as we now know them, the issue of invention was left to the jury and hence these came to be called questions of fact. Later patent suits came to be tried in equity and many rules of law respecting invention developed. The old view that invention was a fact issue persisted but is fast fading under the more realistic view (Brief 13). A patent application, like a patent, is a legal document. Any question of construction which includes comparison with the prior art necessarily includes an element of law. Therefore, it can no longer be said that the question of patentability is purely one of fact whereby this Court is bound by the strict provisions of Rule 52(a).

The authorities (Appellant's Brief 12, 13) establish that this Court is not bound by Rule 52(a) when the question to be reviewed is one of law or the erroneous application of the rules of law to the facts, as is the case of findings 6 to 10 and of the conclusions of law.

FINDING 3 IS A FACT FINDING AND COMES WITHIN THE PROVISIONS OF THE RULE, BUT IS CLEARLY ERRONEOUS

The error has been treated in the main brief (25-26). The fact that there is no basis for absolute comparison of particle sizes is made evident by the manner in which Appellee strains to make such a comparison by assumptions and interpolations for which he has shown no justification.

The literal fact of the error would not, standing alone, be so important. However, there is a great deal of evidence in this case which was not touched upon at all by the lower Court and, since no opinion was handed down, there is no way of telling whether or not the lower Court understood its significance. The fact that he made one error of fact which is apparent on the face of the documents (Brief 25, 26), at the very least raises a doubt on the point sufficient to justify an independent consideration of all the evidence by this Court, unhampered by the strict provisions of Rule 52(a).

It is of no significance that an effective perlite filter aid might be made (if all the steps of claim 17 are observed) which could respond in particle distribution to claim 17 and likewise to the broad particle size values Thatcher gives for his diatomaceous earth. By the same token expanded perlite of 7.5-12 pound bulk density can be ground to the same size, and even the Appellee admits that this is "inoperative" (Appellee's Brief 11).

To this extent both might be considered "similar" to Thatcher. However, that is a far cry from the connotation that the range of particle distribution of claim 17 is *taught* by Thatcher. Nor does it justify the statements by Appellee (Brief 12, 13) (which may well reflect the thinking of the Trial Court) that:

> "Here again the claim is broad enough to cover the prior art as well as what applicants have done."

Thatcher teaches nothing of perlite and he must not be treated as though he does, despite Appellee's repeated implications to that effect. Thatcher deals with:

> ". . . inorganic solid materials adapted for manufacture of filter aids, such as diatomaceous earth (*otherwise known as* kieselguhr, tripoli, fossil flour, infusorial earth or molar . . . ."

Six names for one material![1]

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[1] **In passing it should be noted that the Appellee conveniently omitted five of these names. This attempt to read a broad concept into the term "materials adapted for manufacture of filter aid" is unwarranted and is on a par with his equally unwarranted statements that Chem. and Met. "suggests the use of expanded perlite of less than 6 pounds per cubic foot density" (Brief 14, also 5). As to the former, it is significant that the Patent Office, even in 1934 when the going was much easier, forced Thatcher to limit all of his claims to the single disclosed "material suitable for manufacture of filter aid", namely, diatomaceous earth.**

As to the latter, Appellee's basis is found in the Chem. and Met. statement that the expanded perlite may weigh "from just a few pounds to 10 pounds per cubic foot" and seeks to have the court accept that as a teaching of "less than 6 pounds". While the Appellee, without justification, casts a slur (Br. 10) at the testimony (J. App. 24, 25) that the expanded perlite

Of even greater importance is the failure to recognize the unexpectedly greater utility and versatility of the product of this invention based not only on superior performance, but because it is not confined to the narrow particle distribution found to be critically essential by Thatcher. This is discussed in detail in Appellant's main brief (31).

One other point should be noted, namely, that the evidence introduced by Dr. Leppla [who is Appellant's Technical Director of the Perlite and Decalite (diatomaceous earth filter aid) Division] was not before the Patent Office. Hence, the implication in Appellee's Brief (7) that there has been a double adjudication on all the evidence is too broad.

THIS COURT SHOULD NOT PERMIT ITSELF TO BE LED DOWN THE BLIND ALLEY OF PARTICLE SIZE DISTRIBUTION

In the proceedings below, as in the Appellee's brief, this invention has been treated as merely involving expanding some perlite and grinding to a fine particle size. To be sure, the particle size distribution is an element in the claim to be taken into account. *But the more important thing is the bulk density limitation.*

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of the prior art had a bulk density of 7½ to 12½ pounds, it is self-evident that to obtain expanded perlite of "less than 6 pounds" bulk density, the ground *ore* would have had to have weighed less than 60 pounds per cubic foot; and to reach the 1 pound lower limit of claim 17, would have to weigh *10 pounds,* at a maximum expansion of 10 volumes. Perlite is solid glass and Dr. Leppla's figure could not be that far off, even if he had an inclination to mislead the court.

If one accepts Dr. Leppla's figure of 75 pounds per cubic foot for the ground ore (he was not even cross-examined on the point), it would have to be expanded *12.5* times—not 10 times—to produce a 6 pound product and *75* times to make a 1 pound material.

The attempt to supplant a definite teaching by a broad and indefinite disclosure is not only unjustified in reason, but becomes specious in the light of the facts.

Unless this is followed all one produces are some tiny pieces of glass having no utility. Expanding the perlite and grinding the product is just so much waste motion.

As is fully treated in the main brief (36-39), a particle shape requisite to useful filter aid can only be obtained when 1-6 pound expanded perlite is processed in accordance with the claim.

Exhibits 8 and 10 particularly show that 6 pounds is the maximum useful limit and that the effectiveness and yield of filter aid increases sharply as lighter and lighter weight aggregate is employed. Where in the art can this be found? Where can the suggestion be found that a person skilled in the art would be expected to move in this direction, away from what the Appellee terms the "inoperative" densities—even if he were led to grind expanded perlite in the first place? The Appellee's trial attorney conceded in his brief that the recited range is critical, and the evidence proves it.

How then can it fairly be said that the process of the claim would have been obvious at the time the invention was made to one skilled in the art and not having the benefit of Appellant's disclosure? This is the question—not what the expert Dr. Leppla would have done as Appellee submits (Brief 8). It seems probable from his testimony (J. App. 20, 28, 29) that he (or a person of ordinary skill) would have recognized the suggested use of expanded perlite as filter aid, for what it was—a statement that could not possibly be true, appearing in a pseudo advertisement—and would have done nothing.

THE APPELLEE'S ARGUMENTS DISTORT THE TEACHINGS OF THE PRIOR ART AND ARE REFUTED BY THE EVIDENCE

In his brief (5, item 2) the Appellee states that the suggested uses (for expanded perlite) included filtering water, and as a filter aid. He further recognizes (Brief 7) that "this article does not describe any process for preparing the expanded perlite for use as a filter aid". He recognizes (Brief 3) that expanded perlite is made up of minute sealed bubbles. No other conclusions can be drawn, therefore, than that the Appellee recognizes in principle that these two articles (Compressed Air and Chem. and Met. support Appellee's position as stated at page 8, Appellee's Brief, that:

> "The burden of Appellant's objection to the article appears to be that it indicates, and would indicate to the person skilled in the art, only that expanded perlite may be used as filter aid without further processing".

It is hard to recognize how any other conclusion can be reached. The Appellee then continues on the same page, stating:

> "Presumably the reader of the article is not supposed to turn his thoughts toward using known processes in preparing the new material for its suggested use."

This asumes (1) that the person skilled in the art would not have recognized the preposterousness of the statement and (2) that he would have resorted to a grinding step, as Thatcher did with a totally dissimilar material.

But why, in the absence of Appellant's disclosure, would he be led to do that? A stick of wood can be made into little sticks by cutting it up. But you cannot make little glass balls by smashing big ones—they cease to be balls. The same is true of expanded perlite particles. Perlite is glass. Expanded perlite is glass in cellular form. Destroy the cellular structure and what do you have? *Powdered* glass! This is a commodity which has been known for some time—but it is not a filter aid.

What might one skilled in the art be expected to do, if he did anything? Would he not logically make *expanded* perlite of smaller particle size? Would he not do this by starting with ore ground to a mesh size *which when expanded by heat, as taught in Chem. and Met. would yield* EXPANDED PERLITE of a mesh size such as might be used in the filter aid art?

The Appellant has done this (J. App. 86) and proved that it is as completely ineffective as the 40-80 mesh expanded perlite of Compressed Air Magazine.[2]

The Appellee's statement (Brief 7) that the Chem. and Met. article *"does not describe any process for preparing the expanded perlite for use as filter aid"* is factually true but is misleading. He should have said that the heat expansion process for manufacturing expanded perlite for its *suggested* use as filter aid does not produce a filter aid; that the article does not state or suggest that the product needs any further preparation for use as filter aid; nor that it is a suitable raw material for manufacture of a filter aid; nor is there described or suggested a process by which a filter aid can be made.

By the time he has reached pages 12-13 of the brief Appellee has convinced himself that claim 17 is *anticipated* by the art and more particularly by Thatcher (as is specifically called for by finding 7). The evidence is clearly and unmistakably to the contrary.

Appellant respectfully submits that the Trial Court committed reversible error with respect to finding of fact 3 which error is apparent on the face of documents before this Court; and also by failing to properly apply rules

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[2] The Appellee says (Brief P. 13) that "Obviously a filter aid that floats would be of no value." If particles have the requisite shape there is no reason to believe (and certainly no evidence to show) that it would make any difference whether they were lighter or heavier than water. Naturally a method different from Thatcher's would be needed to determine particle size if they did not subside in water.

of law to the evidence with respect to findings 6 to 10 and the Conclusions of Law, for the reasons and based upon the authorities cited herein and in the main brief.

Appellant prays that the decision of the lower Court be reversed.

Respectfully submitted

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Of Counsel